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# **OPERATIONS AND MAINTENANCE MANUAL**

**MISSOURI RIVER  
INDUSTRIAL PARK LEVEE  
COUNCIL BLUFFS, IOWA**



**June 2016**

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## **SECTION 1 INTRODUCTION**

The purpose of this manual is to provide guidance, instruction, and information for the City of Council Bluffs, Iowa (City) and responsible property owner personnel regarding the appropriate operations and maintenance of the Industrial Park Levee (IPL) and associated project elements. The intent of this manual is to be a living document that will evolve as: 1) design is completed and input is solicited, 2) improvements are completed, 3) experience is gained from future flood fighting events, 4) the levee system ages, and 5) state of practice or design standards change.

### **1.1 PROJECT DESCRIPTION**

The IPL was originally constructed in the mid-1980s for the Council Bluffs Industrial Foundation (CBIF). The IPL was constructed to provide flood risk reduction for the area bounded by the IPL, the Federal Levee System L627, and Interstate 80 (I-80). The original IPL construction included the following:

- Gatewell drainage structures
- Seepage berms
- Closure structures for railroads
- Bin wall and sheet pile retaining wall

These flood risk reduction limits have not changed since the original construction; however, the IPL has been modified since original construction. Modifications include removal of the seepage berms, modification of the northern IPL tie-in, addition of Ameristar Casinos development, removal of some railroad spurs through the levee, and the addition of fencing at property line limits across the levee.

The IPL was also modified in advance of submitting certification documentation to the Federal Emergency Management Agency (FEMA). These modifications included, but are not limited to, the modification of the levee alignment at Ameristar Casinos, raising the levee in locations where the freeboard was deficient, replacing the drainage structures to comply with current industry standard, removal of inactive levee penetrations, rehabilitation of the river bank and riverward levee slope embankment protection, and removal of encroachments which pose a potential risk to the levee's future stability.

### **1.2 PURPOSE OF THE MANUAL**

The purpose of this operations and maintenance (O&M) manual is to provide the personnel responsible for the levee with appropriate guidance and information to properly operate and maintain the levee and related facilities.

This O&M manual is meant to be modified over time as the IPL is modified. Historical IPL information, as relevant, should remain in the appendices of this manual as a record of the existing condition of the levee. Internal components of the manual may change over time as the levee changes, as equipment changes, or as industry standards evolve. Revisions to this manual must be documented in the revision table on the following page (**Table 1**). Upon issuance of a revision, the manual date shall also be updated throughout for version control purposes.

**Table 1: Operations & Maintenance Manual Revisions or Additions**

Revision #	Date (mm/dd/yyyy)	Brief Description of Revisions/Additions

### 1.3 LIST OF REFERENCES

The following references were utilized in the generation of this O&M manual.

*U. S. Army Corps of Engineers (USACE) Guidance:*

- Engineering Technical Letter (ETL) 1110-2-583: *Engineering and Design: Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures* (April 2014)
- *Levee Owner's Manual for Non-Federal Flood Control Works* (March 2006)
- *USACE Emergency Flood Fight Training Manual* (March 2010)
- USACE Northwestern Division: *Sandbagging Techniques* (2004)
- USACE St. Paul District *Flood-Fight Handbook: Preparing for a Flood* (2009)
- USACE Engineering Manual 1110-2-1415, "Hydrologic Frequency Analysis"

*City Documents:*

- *Basis of Design Report (BOD) Industrial Park Levee Phase II Improvements*, October 2015 prepared for the City of Council Bluffs Public Works by CDM Smith Inc.
- *Final VE Study Report Council Bluffs Industrial Park Levee Project*, November 8, 2013 Prepared for City of Council Bluffs, IA by CDM Smith Inc.
- *Industrial Park Levee Stormwater Outfall Improvements Levee Construction Report*, July 2015 prepared by HGM Associates Inc.
- *Industrial Park Levee Stormwater Phase II Levee Construction Report*, (Draft) prepared by CDM Smith Inc.
- *Council Bluffs, Iowa 1980 Plans for Iowa-Nebraska River Industrial Park Flood Protection Levee*
- February 22, 2012 – City of Council Bluffs Technical Memorandum (TM): *Industrial Park Levee – Damage Assessment*

*Other References:*

- ASCE Manuals and Reports on Engineering Practice No. 101: *Underwater Investigations Standard Practice Manual* (2001)
- *Levee Owner's Manual for Non-Federal Flood Control Works*, USACE March 2006

## SECTION 2 AGREEMENTS

The following sections document the agreements in place for the O&M of the IPL.

### 2.1 LOCAL COOPERATION AGREEMENTS

Upon initial construction of the IPL, the landowners behind the levee and the City entered into an agreement. This agreement was made on December 7, 1983, was titled *Levee Maintenance Agreement and Easement*, and was recorded in Book 84 starting on page 11239. This agreement between the City and landowners consisted of stipulations regarding responsibility for O&M, an easement providing access for O&M, and associated responsibility of cost to reimburse the City for repair costs associated with the IPL. This agreement also stipulated that the terms and conditions would transfer with the land if the land were to transfer ownership because of sale or by inheritance. This agreement is attached in **Appendix A**.

As a result of the work being performed in support of FEMA certification on the IPL, additional easements are being pursued by the City to replace the 1983 *Levee maintenance Agreement and Easement*. New easements will reflect current land ownership and will reflect adjusted percentages associated with responsible costs for levee repairs and modifications. The new easement extents will extend 15 feet from the toe of the levee on the dry side, or the face of the nearest permanent structure if 15 feet cannot be met. The easement extents for the wet side of the levee will match the existing property boundaries and extend riverward where access is needed for outfall structure maintenance. Preliminary revised easement exhibits and updated 2011 assessment schedule are in **Appendix A**. Final revised easement agreements will replace the preliminary in **Appendix A** upon completion.

### 2.2 REVISIONS OR ADDITIONS

This section is used to summarize revisions to existing agreements or additional agreements in place governing the modification, access, payment, and O&M responsibility for the IPL. See **Appendix A** for existing, revised, or new agreements. Revisions of existing agreements will be denoted with asterisks next to the page number and demarcation of text changes by underlining or striking out. New agreements will be added to the end of the Appendix with applicable date stamps, as applicable. Changes and additions will be summarized below in **Table 2**.

**Table 2: Log of Agreement Revisions or Additions**

Revision #	Date (mm/dd/yyyy)	Revision or Addition	Description

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## **SECTION 3 PROJECT DESCRIPTION**

The following provides information regarding the current state of the IPL, with a description of levee.

### **3.1 LOCATION**

The IPL is located in the City along the left bank of the Missouri River between river miles 613.9 and 614.7 just north of the I-80 Bridge. The IPL is located in Pottawattamie County, Iowa in Section 4, Township 74 North, and Range 44 West. The IPL provides flood risk reduction for the area bounded by the IPL to the north and west, the federal L627 levee to the east, and the I-80 embankment to the south.

### **3.2 BRIEF DESCRIPTION OF PROJECT**

The IPL received certification for the Ameristar “Boat Slip” area between approximate levee stationing 244+50 and 249+00. FEMA took action and accepted conditioned Phase I Boat Slip certification on August 31, 2015. Improvements to the IPL outside of the “Boat Slip” area have been completed to bring it into compliance with FEMA requirements and certification for the remainder of the IPL system is currently being pursued. This O&M manual is intended to meet the criteria described in the 44 Code of Federal Regulations 65.10 (44 CFR 65.10), parts (c) and (d), requiring an officially adopted operation and a maintenance plan for certification of the entire IPL system. The O&M manual has been approved by the City of Council Bluffs and the private property owners of the IPL to serve as the official operations and maintenance guidance document for the IPL.

### **3.3 HISTORY**

Original IPL construction drawings were completed in September 1980. IPL construction was completed in 1983. The IPL was constructed to provide flood risk reduction at the level of the base flood, or the 100-year event. The IPL ties into the I-80 embankment on the southern terminus, is routed north along the Missouri River left bank, is routed through Ameristar property, and ties into the federal L627 levee on the northern terminus. The IPL was originally constructed for the CBIF and is currently operated and maintained by the City and the landowners within the flood risk reduction area provided by the IPL. The IPL is currently shown as being accredited on the effective Flood Insurance Rate Map (FIRM) 19155C0560E dated February 4, 2005.

As part of the original IPL construction, 50-foot-wide seepage berms were placed on a 50H:1V slope over the natural foundation materials beyond the landward levee toe in specific locations. The riverward section of levee consists of select fill, while the landward section of the levee starting at the landward levee crest consists of non-select fill. The seepage berms also consisted of non-select fill. These seepage berms, as originally designed, do not currently exist.

Ameristar purchased and developed property north of Cargill in the late 1990s. Based upon conversations with the City and comparison of existing conditions to the record drawings, development adjacent and over the levee was conducted. The levee was modified to be routed

through the main casino building; the parking lot and garage were constructed which consisted of the placement of concrete sidewalk on top of the levee, the boat slip was constructed directly adjacent to the riverward slope of the levee at the northern IPL extent along the Missouri River, and two hotel buildings were constructed along the levee alignment on the Missouri River.

During the summer of 2011, the Missouri River exceeded flood stage for 102 consecutive days beginning in late May. During this period of variable water surface elevations (WSELs), the IPL was closely monitored. Additional flood risk reduction devices were installed along and on top of the IPL that included the following:

- Concrete overrun blocks were placed on top of the levee along the IPL along Warren Distribution and Cargill property
- Hesco barriers were placed along the levee on Ameristar property
- Emergency sand blankets were added on the landward levee slope along Warren Distribution and Cargill property
- Outfall structures were plugged with concrete during the flood event
- Riprap was installed in some locations on the riverward slope of the levee to counteract the erosive forces of the river

The City initially contracted with HDR Engineering Inc. for the analysis of the IPL system with respect to FEMA certification requirements. The City is now contracted with CDM Smith for pursuing conditioned IPL FEMA certification Phase II in the Spring of 2017, and to complete necessary improvements to the IPL to achieve certification. Levee modifications were designed and subsequently implemented in two construction phases. The first phase of construction included new culverts and outfall structures, removal of plugged outfall penetrations, and restoration of the levee adjacent to that work. The second phase of construction included increasing the levee height in designated locations, the installation of under seepage controls, bank stabilization measures, installation of two new outfalls on the Ameristar property and re-establishment of rock and vegetation. IPL construction improvements were completed in June 2016. Upon Phase I and Phase II certification, the IPL will work to achieve FEMA IPL accreditation for the future.

## SECTION 4 GENERAL PROCEDURES

The following section provides general procedures in support of O&M activities during non-emergency events.

### 4.1 RESPONSIBLE PARTY

One person from each property owner provided flood risk reduction by the IPL shall serve as the contact person for the IPL and associated O&M activities. This person shall also be responsible for coordinating with other IPL responsible parties and for coordinating updates to the O&M manuals. **Table** summarizes the responsible parties for each applicable property owner.

**Table 3: IPL Responsible Parties**

Property Owner	Property Owner Responsible Party Title
Ameristar	Director of Facilities
Cargill	Plant Manager
Warren Distribution	Director of Risk Management
City of Council Bluffs	City Engineer
DEB Partners	Majority Shareholder

### 4.2 KEY RESPONSIBILITIES

The City of Council Bluffs shall be responsible to ensure that all operations and maintenance activities are performed according to the requirements of this document. The responsible party for the City of Council Bluffs shall be the City Engineer. The responsible parties associated with each property owner shall be responsible for coordination on IPL emergency events, flood fight efforts, and repairs.

#### 4.2.1 Personnel Training

Key personnel that will be working on the IPL shall be trained in order that regular maintenance work may be performed efficiently and to provide an orderly and expeditious manner in which unexpected problems related to flood control can be handled. The Property Owner Responsible Party shall be responsible for training personnel to operate, maintain, and patrol your section of IPL. It is encouraged that property owners hold joint training or flood control exercises at least once a year. There are many reasons to hold these exercises. First, they are used to coordinate training for new personnel with the other owners. The training shall consist of how to do things like operate the closure structures, respond to sandboils and patrol the IPL during a flood. The USACE Levee Owner's Manual for Non-Federal Flood Control Works can be used as a training resource for new employees.

Second, the plans developed for flood response are only useful if practiced and communicated to those who need them. The Property Owner Responsible Party shall have the names, addresses, and telephone numbers for key personnel assigned to various tasks of IPL coordination. This contact list shall contain a reasonable number of substitutes. These key personnel shall have contact information for all workers and staff that will be assisting them in the completion of their duties. The organization of key personnel shall include the following:

- An assistant in the place of the Property Owner Responsible Party in the event of absence or indisposition.
- IPL sector foreman and sufficient number of lead maintenance patrol workers to inspect and ensure the proper operation of levee and other structures during normal operation and flood periods.

#### **4.2.2 Record Keeping**

Each Property Owner Responsible Party shall maintain a file of reports, records, drawings, and this O&M manual. The file shall be readily accessible to the appropriate personnel associated with the IPL.

#### **4.2.3 Right-of-Way Access**

Right-of-way (ROW) access must be granted at all times for the operations, maintenance, and flood fighting associated with the IPL. Other property owners and the City must have access granted at all times to the entire levee alignment, including the levee crest, the levee wet side, and the levee landward side. ROW access on the levee landward side shall include the area adjacent to the levee up to 15 feet from the levee landward side toe.

Each Property Owner Responsible Party shall post notices at various places along the IPL ROW directing public attention to the intent of the levee and the primary use and limitation of public access or use. Each Property Owner Responsible Party shall report to key personnel and local law enforcement, as necessary, of any offenders to take whatever action is required under local ordinance and authority to properly inform and/or prosecute trespassers.

#### **4.2.4 Flood Warning System**

A single point of contact (Designated IPL Representative) elected from the IPL Membership shall report on the functions of all agencies, both public and private, that are connected with the IPL. Arrangements shall be made with local law enforcement agencies, City departments, and utility companies for developing a coordinated flood fighting program.

The City shall also maintain a Designated IPL Representative responsible for coordinating with respect to monitoring the flood warnings initiated by the National Weather Service in Valley, Nebraska and by Pottawattamie County's emergency alert system. The website for the National Weather Service Valley, Nebraska regional office is: <http://www.crh.noaa.gov/oax/>. The flood warning system including event detection and level determination to provide adequate flood warning time, as well as flood fighting operations and maintenance are discussed in detail in Section 6.

The Pottawattamie County, Iowa Emergency Communications Network CodeRED system is available to all residents and businesses of the county at no-charge. The Pottawattamie County Emergency Management Agency (PCEMA) implemented the Emergency Communications Network's CodeRED systems in order to provide notification to allow public officials to warn citizens of pending emergencies, critical public information during disasters, recommended protective actions to take, and severe weather warnings, including flood warnings.



Residents and businesses participate in the Emergency Communications Network CodeRED system by registering on the Pottawattamie County website. Residents and businesses choose whether or not they want to receive general notifications or just severe weather warnings. Each registered recipient can further customize severe weather alerts to include tornado, severe thunderstorm, flash flood, and winter storm warnings. At any time, users can log in and change all of the information expressed in this paragraph.

### **4.3 SUPPLIES FOR REPAIRS**

Supplies shall be kept on hand or be readily available in order to be used for regular maintenance and emergency repairs. A maintenance facility shall be located within close proximity to the IPL to serve as a storage area for supplies, such that supplies may be transported to the site within one day to provide adequate flood fight response time. Supplies for temporary closure of portions of the IPL must be specifically designated and readily available at all times.

### **4.4 COORDINATION WITH OTHER AGENCIES**

The IPL Representative shall establish coordination with the Property Owner Responsible Party or other agencies that may impact the IPL or that may be impacted by the IPL during the course of normal O&M or during flood events.

### **4.5 COORDINATION OF OWNERS FOR FUTURE DEVELOPMENT ACTIVITIES**

Future development activities completed by the IPL Owners within existing low areas have the potential to increase flooding on the property of another Owner. To mitigate against the potential for this to occur, any Owner proposing to develop within the areas of 1-percent annual chance flooding shown in the Figure “Interior Flood Boundaries” included in Appendix A shall complete a study showing the impact the proposed development would have on the properties of all other Owners. This study shall be sealed by a qualified professional engineer and shall, at a minimum, complete a coincident frequency analysis in accordance with the requirements of the USACE Engineering Manual 1110-2-1415, “Hydrologic Frequency Analysis” to determine 1-percent annual chance flood boundaries under post-development conditions for all areas protect by the IPL. The study shall also show proposed grading contours and what measures have been taken to mitigate the impact of the development on the properties of the other Owners. provides a list of contact information for these agencies. This table shall be updated as necessary to reflect personnel changes in the agencies listed below.

**Table 4: Agency Contact Information**

Contact Name	Address	Contact Information	
City of Council Bluffs Designated IPL Representative			
Matt Cox	209 Pearl Street Council Bluffs, IA 51503	Phone	(712) 328-4634
		E-mail	mcox@councilbluffs-ia.gov
		Website	www.councilbluffs-ia.gov
Iowa Department of Natural Resources (IDNR)			
Bill Cappuccio	502 East 9 <sup>th</sup> Street Des Moines, IA 50319	Phone	(515) 281-8942
		E-mail	bill.cappuccio@dnr.iowa.gov
		Website	www.iowadnr.gov
Iowa Department of Transportation (IDOT)			
Scott Schram	2210 E. Seventh Street Atlantic, IA 50022	Phone	515-239-1604
		E-mail	scott.schram@dot.iowa.gov
		Website	www.iowadot.gov/district4/index.htm#
National Weather Service			
David Pearson	6707 North 288 <sup>th</sup> Street Valley, NE 68064	Phone	(402) 359-5166
		E-mail	david.pearson@noaa.gov
		Website	www.crh.noaa.gov/
Pottawattamie County Emergency Management			
Douglas Reed	227 South 6 <sup>th</sup> Street Council Bluffs, IA 51501	Phone	(712) 328-5776
		E-mail	pott.ema@pottcounty.com
		Website	www.pottcounty.com
United States Geological Survey (USGS)			
Matt Noon	8 South 6 <sup>th</sup> Street Suite 260 Council Bluffs, IA 51501	Phone	(712) 323-8024
		E-mail	mjnoon@usgs.gov
		Website	ia.water.usgs.gov
USACE – Levee Safety			
Andrew Barry	1616 Capitol Avenue Suite 9000 Omaha, NE 68102	Phone	(402) 995-2231
		E-mail	andrew.l.barry@usace.army.mil
		Website	www.nwo.usace.army.mil
USACE - Floodplain			
Randall Behm	1616 Capitol Avenue Suite 9000 Omaha, NE 68102	Phone	(402) 995-2322
		E-mail	randall.l.behm@usace.army.mil
		Website	www.nwo.usace.army.mil

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## **SECTION 5 ROUTINE INSPECTION AND MAINTENANCE**

It is incumbent upon the City of Council Bluffs to coordinate with levee owners and operators to maintain an effective routine inspection and maintenance plan. Proper and adequate levee maintenance is essential in order to ensure its operability during flood events. Typical operations and maintenance activities may be performed by the City of Council Bluffs at a percentage of the expense of the property owners as outlined in the existing easement agreement (Appendix A). Alternatively, the City may work collectively with each property owners to identify, assign, and complete inspection and maintenance activities. The levee system will be inspected immediately prior to the beginning of the flood season and immediately following major high water periods. High water periods occur when the Omaha gage reaches flood level. This corresponds to a gage water surface elevation of 977.2 feet NGVD, or when the river stage is at 29 feet. Necessary maintenance needs found during inspections must be completed prior to the beginning of the subsequent flood season. Past maintenance and inspection records and reports will be either completed by, or submitted to for review by to the City of Council Bluffs annually to ensure proper working condition of all components of the IPL system. Any levee feature that has not undergone any inspection and/or maintenance and repair within the past year will be inspected, and required maintenance and repair will be undertaken before the onset of flooding. A review will be conducted at the beginning of each year to ensure that personnel are appropriately trained and available for performing the duties assigned to them.

Each property owner will keep a duplicate copy of the O&M manual for their use in referencing required IPL procedures. A master copy of the O&M manual will be kept at the City of Council Bluffs City Hall, Public Works department. When updating the O&M manual with levee improvements, new IPL monitoring procedures, inspection and/or maintenance logs, or new personnel, all copies of the O&M manual need to be updated, and a copy must be submitted to FEMA for their records.

The following sections identify standard maintenance practices to be performed during non-emergency events. See additional recommended practices in **Appendix B**.

### **5.1 LEVEE**

The City of Council Bluffs and each Property Owner Responsible Party will maintain either a list or an annotated map that describes each levee feature and areas of concern during a flood event. An annotated base map for the IPL with levee features can be found in **Appendix B**. The list shall clearly note:

- Areas where significant erosion was experienced in the past.
- All low areas within the immediate vicinity of the levee.
- Locations that are subject to sand boils.
- Areas of known seepage and over saturation during past flood events.

- Rodent activity areas observed in the recent past.
- Alternate access points to the levee (should the primary access point become impassible).
- Locations of drainage structures that shall be checked for closure.
- Available sources and locations of borrow material, sand, sandbags, pumps, and other supplies.
- Other potential issues or supplies as necessary towards proper functioning of the levee.

The levee system and its immediate vicinity will be inspected. Appropriate remedial measures will be undertaken to address any identified issues that may be detrimental to the performance of the levee system.

- Any seepage, unwarranted saturation, or sand boils will be identified and corrective measures evaluated and performed.
- Revetment or rock riprap that has been displaced, washed out, or removed will be replaced with materials conforming to specifications and design dimensions. Rocks will be inspected for fracturing due to freeze-thaw cycles and replaced as deemed necessary.
- Vegetation present that can prove to be detrimental to the structural integrity of the levee or hinder in the performance of the levee system during flood events will be removed. Vegetation shall only consist of those approved grasses provided as a recommended seed mixture from USACE (see **Appendix B**). This grass cover shall be regularly mowed and maintained such that rodent holes and soil characteristics can be viewed while walking along the levee. In no case shall woody vegetation or grasses taller than one foot be allowed.
- The levee sheet pile wall located along the northern reach of the IPL adjacent to the Ameristar boat slip shall be visually inspected annually. More-detailed inspections of the sheet pile wall shall be performed every 5 years. The detailed inspection shall include an underwater inspection of the sheet pile toe to check for loss of ground from settlement or scour, and ultrasonic thickness measurements in accordance with ASTM E-797 shall be performed at any location where corrosion ratings of minimally acceptable or unacceptable were recorded during the annual inspections. Locations tested during the detailed inspections shall be tested in subsequent detailed inspections, and the results shall be evaluated by a qualified professional engineer licensed in Iowa. Recommended inspection items for the sheet pile wall are included in **Appendix B**.
- The levee stem wall located along the western reach of the IPL adjacent to the Cargill office area shall be visually inspected annually.
- Encroachments on the ROW of the levee will be documented. Encroachments may endanger the structural integrity of the levee and/or hinder efficient functioning during times of emergency.
- Gates and fences to the levee will be inspected for good working condition.

## **5.2 EMBANKMENT PROTECTION**

The embankment of the levee will be observed during scheduled inspections to locate any hazardous or structurally detrimental conditions that may have developed since the last inspection and will be promptly repaired to the normal operating conditions. Specific inspection and maintenance items will include:

- The embankment of the levee will be maintained at the effective cross-section and grade as shown on the levee as-built drawings. Any materials lost will be replaced to return the embankment to its intended dimensions and grade.
- All depressions or settlements on the embankment crown will be filled in with suitable material.
- An animal burrow control program that includes the elimination of active burrowing and the filling in of existing burrows with proper material conforming to specifications. Burrows created by gophers, muskrats, opossums, badgers, and other animals can lead to rapid levee failures during floods. For this reason, an active animal abatement program shall be implemented to remove these animals. Rodent control techniques involving fumigation, bait stations, bait broadcasting, or trapping have proven effective in certain situations, the Iowa Department of Natural Resources can be contacted to determine which rodent control procedures are allowable and recommended at the IPL. Any unusual settlement, sloughing, or material loss will be filled in with proper material conforming to specifications and repaired.
- Cracks in the levee embankment due to freeze-thaw cycles will be repaired.
- Erosion protection will be maintained as shown on the levee as-built drawings. Any material lost will be replaced.
- The levee will be mowed and maintained so that the levee will have little or no unwanted vegetation (trees, bush, or undesirable weeds). The vegetation-free zone extends 15 feet from both the landside and riverside toes of the levee to the centerline of the nearest tree.

### 5.3 HYDRAULIC STRUCTURES

During scheduled inspections all interior drainage hydraulic structures controlled by IPL membership, not including any City owned and maintained infrastructure, will be inspected to ensure that:

- All culverts are free of any debris and ice buildup. Any obstructions or blockages will be removed to allow for full discharge capacity and proper functioning of the interior drainage system.
- All inlets to the pipe culverts are free of debris. Any accumulated debris or sediment will be removed from the inlets.
- The outlet structures are free of potential obstructions to full closure, like debris that may have wedged in.
- Drainage pipes and inlets for the Ameristar roof drains located along the western reach of the IPL adjacent to the hotels and the northern reach of the IPL adjacent to the Ameristar parking garage shall be visually inspected annually. More-detailed inspections of the pipes shall be performed every 5 years. The detailed inspection shall include television camera videotaping or visual inspection methods to evaluate the condition of the entire pipe segment.
- Gate operators are functioning properly. Maintenance and repairs will be performed to address any gate closure problems. Recommended inspection items, testing, maintenance and repair procedures for the gates can be found in **Appendix B**.

## 5.4 CHANNELS

All interior drainage ditches shall be inspected to ensure that they do not have tall and dense vegetation, significant sediment deposits, and any other debris or obstructions. All accumulated debris and blockages will be removed to the channel bottom to provide full discharge capacity of the drainage ditch.

## 5.5 UNDERSEEPAGE CONTROL MEASURES

Installed relief wells, toe drains and underfloor drainage systems shall be inspected for any unusual wetness, and remedial measures will be undertaken to rectify any unnatural conditions. Seepage berms will be inspected to ensure that designed grades and dimensions are in place. Any loss of materials will be filled with suitable material, and undue saturation or wetness observed will be noted and remedial measures applied.

Relief wells require a certain amount of nominal maintenance to ensure their continued and proper functioning. Any trash or obstruction in the well or well guard shall be removed immediately.

Relief wells shall be inspected annually, preferably immediately prior to normal high-water seasons and more often during major high waters. Observation shall be made for evidence of wet spots on the levee or on the ground around the wells and structures, for evidence of sloughing or piping, for indications of discharge of sand or other materials from the wells, and for surficial signs of damage. The inspection shall detect whether vandalism, theft, abuse by carelessness, unauthorized use of the wells or associated piezometers, or other irregularities have occurred. The inspection shall include an examination of check valves, gaskets, well guards, cover plates, flap gates on tee outlets, and other appurtenances. Malfunctioning or damaged items shall be repaired or replaced. Flow quantities and piezometric levels shall be measured approximately a week after a peak in the river level.

Pumping tests shall be performed at five-year intervals. The tests shall be performed to determine the specific capacities (pumping rate divided by drawdown) and the efficiencies of the wells. The amount of sediment in the wells shall be measured before and after performance of the pumping tests. The analysis of well discharge records and accompanying piezometric data will often indicate whether the relief wells are functioning as intended.

Relief wells may not function as intended and may also be subject to reduced efficiency with time. If the pumping tests indicate a reduction in specific capacity of more than 20 percent compared to that shown on the as-built well pump test results located in **Appendix C**, a qualified professional engineer licensed in Iowa shall be employed to perform a detailed study of the well and to determine what remedial measures are required. Generally, it may be possible to restore the wells to about their original efficiency by means of rehabilitation techniques. Forms to be filled out for relief well pump tests are included in **Appendix D**.

## 5.6 ACCESS ROUTES

Access routes to the levee will be inspected during scheduled routine maintenance and inspections to ensure that the routes are passable by vehicles and equipment that will be used during flood fighting emergencies. Repair and maintenance will be performed on the access routes in consultation with the adjacent property owners.

## **SECTION 6 FLOOD-RELATED INSPECTION AND MAINTENANCE**

The IPL provides flood risk reduction at the base flood level for the property owners between the IPL and the federal levee system. However, the structure is vulnerable during high flood stages. Overtopping of the levee during high flood stages could lead to erosion by wave wash. Scour or seepage through or beneath the levee can also be a threat to its stability. To be prepared for high flood events, adequately trained personnel shall be charged with the responsibility of inspection and for providing remedial measures for the levee.

Inspection and maintenance crews shall have the following supplies readily accessible during flood-related activities:

- Cell phone
- Log book
- GPS data logger
- Flashlights
- Life jackets
- Safety line
- Probing rod
- Camera
- Field boots
- Hard hats
- Personal protect equipment as deemed required by each property owner

### **6.1 PRE-FLOOD PREPARATION**

Appropriate advance measures will be taken to ensure availability of adequate labor and materials to meet all contingencies during the forecasted flood event. Supplies specifically designated for temporary closure for identified portions of the Boat Slip shall be readily available at all times.

#### **6.1.1 Communication**

The IPL Designated Representative shall be responsible for coordinating with the Property Owner Responsible Parties to keep apprised of the flood, agency predictions, and coordinated flood fighting measures. The responsible parties for each property owner will also be responsible for monitoring the flood warnings in the relevant reach of Missouri River by the National Weather Service and USACE. All personnel involved in inspection and flood fighting operations will be alerted and the IPL Designated Representative will be responsible for coordinating with the responsible parties for each property owner to schedule pre-flood inspection of the levee by trained personnel. The responsible parties for each property owner will ensure that adequate supplies are available for flood fighting operations as determined during the pre-flood inspection operations.

The responsible parties for each property owner will be responsible for notifying key personnel of the procedures that will be followed and the predetermined routes that will be taken if the area provided flood risk reduction by the levee is required to be evacuated. Local law enforcement and emergency operations will be informed of the potential flood situation. Keys to the locks on any gates leading to access to the levees will be made available to inspection personnel.



### 6.1.2 Supplies

In addition to inspection and maintenance crew supplies outlined in the beginning of Section 6, the following supplies will be stockpiled on the landward side of the levee at an adequate and easily accessible location for pre-flood preparation activities.

- Plastic sheets to provide a water tight seal for deployment of sand bags.
- Sand bags to provide emergency stabilization. Sand bagging material shall be woven polypropylene, spun-bonded polypropylene, or jute burlap.
- Sandbag filling equipment such as shovels.
- Emergency lighting to allow for inspection and flood fighting during night.
- Emergency pumps to allow for the removal of ponded water from the dry side of the levee.
- Source of borrow material shall be identified within reasonable distance and easy reach for riprap material of the grade and size used for protection of the IPL, levee fill, sand berms, and sand for filling sand bags.

Additional flood fighting supplies as determined by the responsible personnel shall be stored in an easily accessible location on the landward side of the levee. A list of suggested suppliers and contact numbers are listed below.

Item	Contact
Plastic Sheeting	Menards Address: 3200 Manawa Center Dr, Council Bluffs, IA 51501 Phone:(712) 366-695
Shovels	Menards Address: 3200 Manawa Center Dr, Council Bluffs, IA 51501 Phone:(712) 366-695
Sand bags	All Road Barricades, Inc. Address: 5700 Ballard Avenue, Lincoln, NE. 68529-9196 Phone: (402) 467-2553
Emergency Lighting	United Rentals Address: 811 S 48th St, Omaha, NE 68106 Phone:(402) 556-1600
Emergency Pumps	Griffin Dewatering Address: 6414 S 84th Street, Omaha, Ne 68127 Phone:(402) 331-5000
Borrow material	Martin Marietta Aggregates Address: 10755 Mitchell Rd, Papillion, NE 68046 Phone:(402) 592-9364

### 6.1.3 Levee System Temporary Measure Deployment

The responsible parties for each property owner will be responsible for ascertaining that all personnel are familiar with the operating procedures and that sufficient inspection and maintenance personnel, supplies, and equipment are available for flood fighting operations.

The levee will be inspected by trained personnel when notice is received of a National Weather Service-predicted Missouri River high flood event. Any settlement or erosion of the levee crest will be corrected immediately. Slides or sloughs that alter the effective section of the levee will be repaired to restore the cross-section of the levee to the design dimensions. Animal burrows penetrating the effective section of the levee will be filled, compacted, and sealed. Vegetation shall be monitored, managed, and removed prior to becoming potentially detrimental to the structural integrity of the levee. All access routes to the levee will be inspected and repairs made to ensure easy access to the levee during the high flood event.

All interior drainage hydraulic structures will be inspected and any debris and ice buildup will be removed to allow for full discharge capacity and proper functioning of the interior drainage system. The interior drainage ditch between the IPL and the federal levee will be inspected, and any accumulated debris, sediment depositions, and blockages will be removed to provide full discharge capacity of the drainage ditch.

The outlet structures will be inspected and cleaned for potential obstructions to full closure, like debris, and gate operators will be inspected and exercised to ensure proper functioning during the flood event. The threads shall be lubricated and the seals shall be monitored and replaced as necessary for proper function. If for any reason the outlet systems on a drainage structure fail to operate or close fully and cannot be repaired before the flood event, immediate consideration will be given to blocking the drainage structure opening by other means. Per guidance in the USACE manual *Flood-Fight Handbook: Preparing for a Flood* (issued by the St. Paul District), emergency stoppers may be a manufactured device or constructed blockage using lumber, sandbags, or other materials using polyethylene as a seal.

If it is determined that Missouri River WSELs will overtop the levee during the forecasted high flood event, concrete overrun blocks or filled Hesco baskets will be placed over the levee crest to provide additional freeboard. The blocks will be wrapped with plastic sheets to provide water tight seals with sandbags placed at the top and base of the blocks to hold the plastic sheets in place and otherwise installed per manufacturer instructions.

### 6.1.4 Event Detection and Level Determination

When an event, or impending event, is detected at the levee, the level of the event must be determined. Events may be detected by observations at or near the levee, forewarning of event-level conditions (such as in the form of a severe weather forecast), suspicious activity, or a security threat. Once an event has been detected, the Property Owner Responsible Party must determine what level of event has occurred. Events may consist of the following:

- **Unusual Event Level:** An unusual event level is defined as a slowly developing situation that may compromise the structural integrity of the levee. This event shall be closely monitored and all responsible parties shall keep key personnel informed of the status of the event. Emergency preparedness agencies do not need to be notified for an unusual event.
- **Watch Event Level:** A watch event level is defined as a rapidly developing situation that may become a serious emergency, including possible levee failure. Temporary closure measures for the IPL shall be implemented at watch event levels. Time is usually available to attempt temporary or corrective measures to mitigate or prevent the levee's

failure. All responsible parties shall keep key personnel informed of the status of the event. Emergency preparedness agencies shall be notified and provided with updates to the situation.

- Warning Event Level: A warning event level is defined as a levee failure that has already occurred. Time is not available to try temporary or corrective measures. All responsible parties shall notify key personnel immediately and continue to keep them informed as the situation develops. Emergency preparedness agencies will be notified immediately so that property owners, employees, and residents outside the levee flood risk reduction area can be informed on the situation and status.

**Table** shall serve as an aide in determining the level of event that is occurring. This table provides a list of some situations that could occur for a levee system.

**Table 5: Event Level Determination Guidance Table**

Event	Situation	Event Level
Embankment Overtopping	River level is 4.3 feet below the top of levee (Temporary Closure Deployment)	Watch
	River is flowing over the top of levee	Warning
Seepage	New seepage areas in or near the levee	Unusual
	New seepage areas with apparent material movement or increasing flow rate	Watch
	Seepage areas have resulted in significant loss of material or flow rate has increased significantly	Warning
Sinkhole	Observation of new sinkhole in levee embankment or within close proximity to levee toe	Watch
	Rapidly enlarging sinkhole	Warning
Embankment Cracking	New cracks in the embankment greater than .25 inch wide without seepage	Unusual
	Cracks in the embankment with seepage	Watch
	Cracks have widened or lengthened significantly over a short period of time	Watch
Embankment Movement	Visual movement and/or slippage of the embankment slope	Unusual
	Sudden or rapidly proceeding slide of the embankment slope	Warning
Sabotage/ Vandalism	Damage to levee or appurtenances with no impacts on levee function	Unusual
	Modification to the levee or appurtenances that could adversely impact levee function	Unusual
	Damage to levee or appurtenances that has resulted in seepage flow	Watch
	Damage to levee or appurtenances that has resulted in uncontrolled flow or river into flood risk reduction area	Warning
Malfunctioning Drainage Structure	Water begins to pond around the drainage structure inlet	Unusual
	Water is not exiting the drainage structure and ponded water begins flooding adjacent areas	Watch
	River level is at the invert of a drainage penetration (Temporary Closure Deployment)	Watch
	Water backflows through drainage penetrations from riverward to landward side of levee	Warning
	Erosion and/or scour holes develop at drainage structures or connections with pipe in levee embankment	Watch

#### **6.1.5 Temporary Closure Measures**

Temporary closure measures shall be implemented by the Property Owner Responsible Party when notification of an embankment overtopping watch event level is received to provide protection against levee overtopping during periods of high water and protect against Missouri River floodwaters flowing into the levee dry side through the levee's stormwater drain penetrations.

**Table 6** lists Missouri River stage flood response monitoring triggers at the Omaha River gage for temporary closures and outfall gate closures along the IPL. All stormwater outfall sluice gates are to be closed when the Missouri River water surface elevation reaches the invert elevation of the outfall pipe.

**Table 6: Flood Response Monitoring Plan**

River Stage at Omaha Gage (ft)	Missouri River WSEL at Omaha Gage (ft NGVD)*	IPL Feature	IPL Station	Closure Elevation at IPL Feature (ft NGVD)**	Action
28.8	977.0	Monitor	204+25 to 254+00		Monitor for increasing WSEL
30.8	979.0	Monitor	204+25 to 254+00		Monitor for increasing WSEL
23.3	971.5	O-1 Warren Outfall	214+50	970.07	WATCH EVENT LEVEL Close 60" Sluice Gate for Warren Gravity Outfall
19.4	967.6	O-2 Cargill Outfall	222+10	966.16	WATCH EVENT LEVEL Close 48" Sluice Gate for Cargill Gravity Outfall
-	-	O-3 River Road Outfall	232+07	-	N/A – City Operations Plans Provide Guidance for Closures of River Road Outfall
22.5	970.7	O-4 Ameristar Outfall	235+90	969.32	WATCH EVENT LEVEL Close 48" Sluice Gate for Ameristar Gravity Outfall
29.5	977.7	O-5 Ameristar Roof Drain S	241+12	976.70	WATCH EVENT LEVEL Close Sluice Gate for 16" DIP Roof Drain Outfall
29.6	977.8	O-6 Ameristar Roof Drain N	244+25	976.73	WATCH EVENT LEVEL Close Sluice Gate for 16" DIP Roof Drain Outfall
32.6	980.8	Boat Slip Area	247+99	979.36	WATCH EVENT LEVEL Deploy temporary measures to top of IPL for additional freeboard
31.8	980.0	River Road Ditch Section	252+93	978.64	WATCH EVENT LEVEL Deploy temporary measures to ditch section for additional freeboard

\* NGVD represents the National Geodetic Survey of 1929 vertical datum. Water surface elevations recorded at the Missouri River Omaha gage are recorded in this vertical datum.

\*\* Feature elevations listed for outfalls are invert elevations. Elevations were taken from as-built survey, which was completed in the North American Vertical Datum of 1988 (NAVD) and converted to NGVD by subtracting 0.38-feet.



The IPL has two areas that require temporary closure by sand bagging or other appropriate manufactured flood barrier alternatives. The first of these areas spans from station 247+04 to 248+65, and is shown on **Figure 1**. The second of these areas is located on the northeast side of River Road and spans from station 252+75 to 253+17.

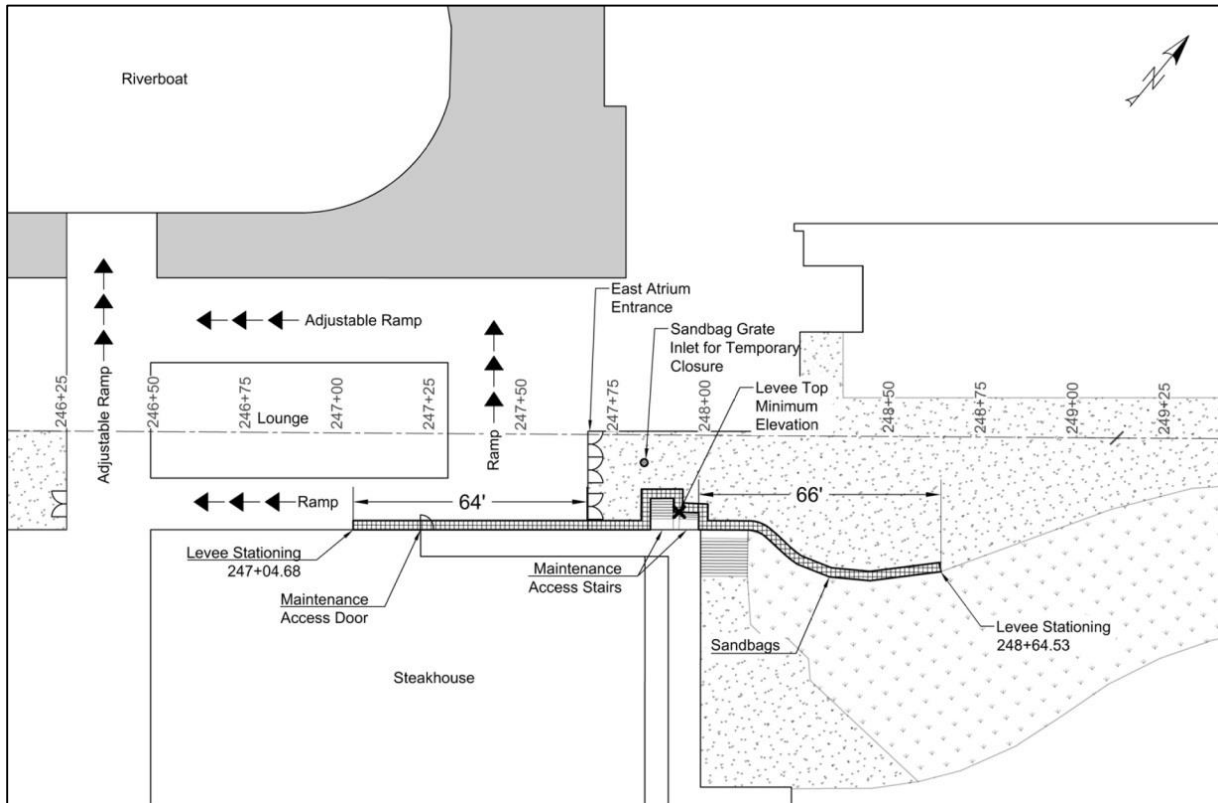
Before placing sandbags or flood barrier, remove any debris from the areas where the barriers are to be placed. If using sandbags, they shall be placed lengthwise and parallel to the direction of flow, filling the lowest areas of the levee top first.

The lowest area of the Boat Slip region along the levee top is located on the east side of the Ameristar atrium entrance, between the two concrete stairs leading up to maintenance access doors, as shown on **Figure 1**. The flood barrier must be built up to a minimum height of 1 foot, or 3 rows of sandbags. If using sandbags, the first row shall be placed aligning the stair bottom to the eastern edge of the building extending northeast to, and aligning the edge of pavement until reaching levee stationing 248+65, approximately 66 feet from the eastern edge of the building. Flood barriers shall be placed southwest of the low point aligning the stair bottom and edge of building up to the atrium entrance doors. This row will then extend inside the atrium aligning the south wall from the east atrium entrance doors for approximately 64 feet, to levee stationing 247+04. Flood barriers will also be placed around the existing grate inlet at levee stationing 247+84, as shown on **Figure 1**, to restrict surface flooding of the structure and the downstream storm sewer system.

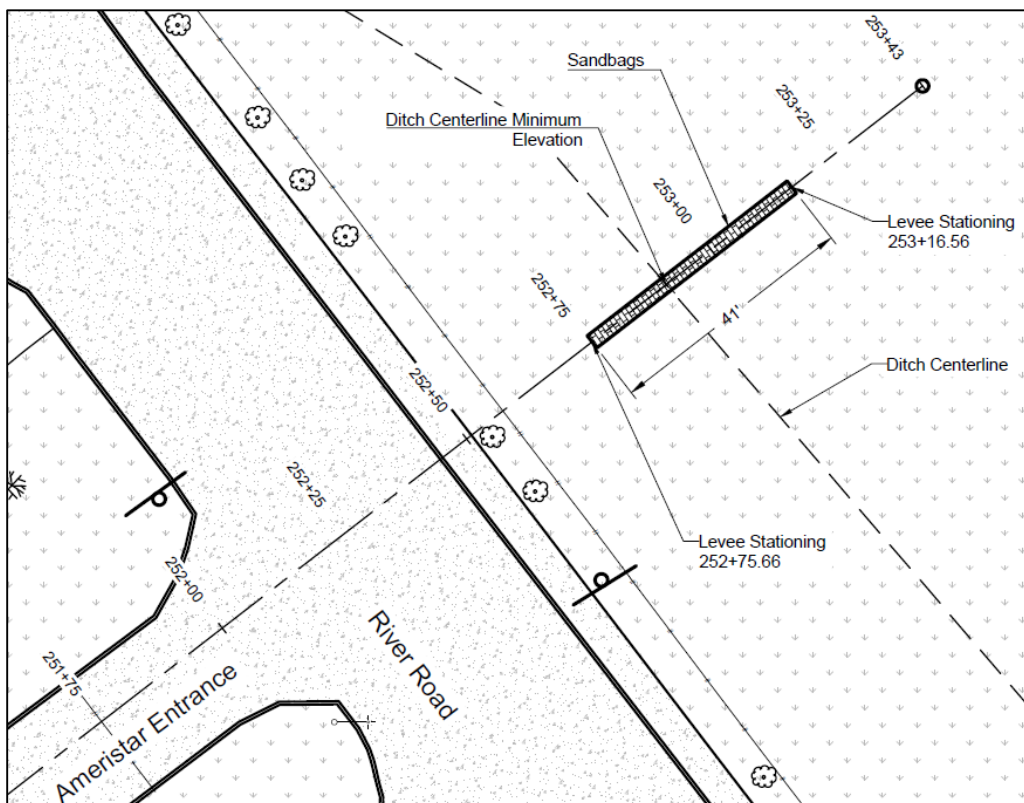
The lowest area of the ditch section northeast of River Road is located at the ditch centerline along the levee alignment where River Road intersects the northern Ameristar entrance drive, as shown on **Figure 2**. The flood barrier must be built up to a minimum height of 1.15 feet, or 4 rows of sandbags. If used, the first row of sandbags shall be placed starting in the ditch centerline, and extending northeast and southwest up the side slopes of the ditch, perpendicular to the flow line for a total length of approximately 41 feet.

For stacking the second and third rows of sandbags use the pyramid placement method described in the USACE Northwestern Division Publication, *Sandbagging Techniques*. Sandbags or flood barriers shall be stacked equal to or above the elevation of the temporary closure along the high point of the levee.

**Figure 1: Ameristar Boat Slip Temporary Closure Layout**



**Figure 2: River Road Ditch Section Temporary Closure Layout**



## **6.2 FLOOD FIGHT OPERATIONS AND MAINTENANCE**

Flood fight operations and maintenance shall be triggered when the when the Missouri River water surface elevation at the Omaha gage reaches flood level, which is defined as a gage water surface elevation of 977.2 feet NGVD, with the river stage is at 29 feet. For safety in times of high water or high flood events levee maintenance shall be thorough and continuous. The entire stretch of the levee shall be patrolled and inspected throughout the flood event by trained inspection personnel. Immediate steps will be taken to correct any dangerous conditions detrimental to the proper functioning of the levee and maintenance personnel must be available to perform emergency repairs to the levee during high flood events. Temporary closure measures will be implemented at the watch level for any flooding event. Property owners will be ultimately responsible for monitoring and repairing their own section of the levee system. As performed in past events, property owners may elect to coordinate and work together on system-wide monitoring and inspections during an emergency event.

### **6.2.1 Communication**

During periods of high flood the Designated IPL Representative will be responsible for coordination between all the agencies and organizations, both public and private that are connected with the IPL. The Ameristar Casino will be utilized as the central emergency communications and operations center for IPL property owners until the emergency flood situation is resolved.

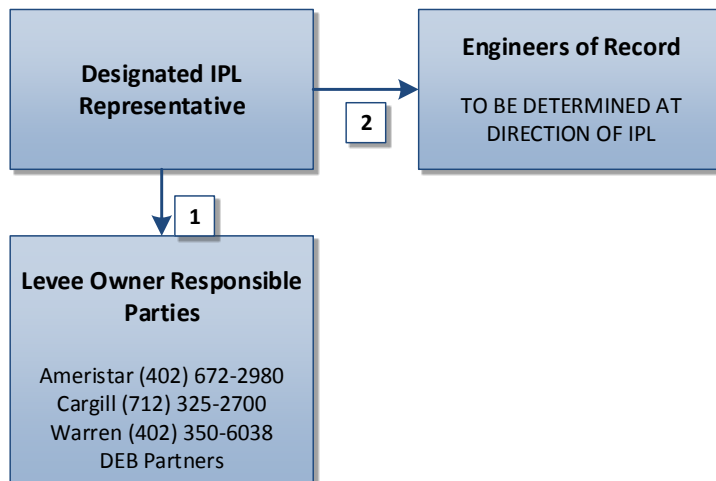
The responsible parties for each property owner will monitor the performance of the levee during high flood events. The observations will be communicated to the Designated IPL Representative, who will initiate evacuation of the areas protected by the levee, if deemed necessary, in coordination with the property owners, local law enforcement personnel, and emergency responders. Responsible levee inspection and maintenance personnel will meet at the Ameristar Casino to confirm safety of all personnel on site and to ascertain the current situation and review responsibilities for carrying out flood fighting and evacuation orders.

**Table 7** lists relevant contact information for the flood fighting operations. **Figure 3, Figure 4,** and **Figure 5** provide flow charts for contact initiation for the three various emergency events.

**Table 7: Flood Fighting Operations Contact Information**

<b>Responsible Party:</b>	Ameristar Casinos	Cargill
Contact Person Title:	Director of Facilities	Plant Manager
Phone Number:	(402) 672-2980	(712) 325-2700
<b>Responsible Party:</b>	Warren Distribution	DEB Partners
Contact Person Title:	Director of Risk Management	
Phone Number:	(402) 350-6038	
<b>Engineer of Record:</b>	To be Determined at direction of IPL	
Contact Person:		
Phone Number:		
<b>Emergency Management:</b>	Pottawattamie County Emergency Management	
Contact Person:	Douglas Reed	
Phone Number:	(712)328-5776	
<b>Council Bluffs Police Chief:</b>	Council Bluffs Police Department	
Contact Person:	Chief Tim Carmody	
Phone Number:	(712)328-4701	
<b>Council Bluffs Fire Chief:</b>	Council Bluffs Fire Department	
Contact Person:	Chief Justin James	
Phone Number:	(712)328-4646	
<b>National Weather Service:</b>	National Weather Service – Valley, Nebraska	
Contact Person:	David Pearson	
Phone Number:	(402) 659-5166	
<b>Internal Contact:</b>		
Contact Person:		
Phone Number:		
<b>Internal Contact:</b>		
Contact Person:		
Phone Number:		

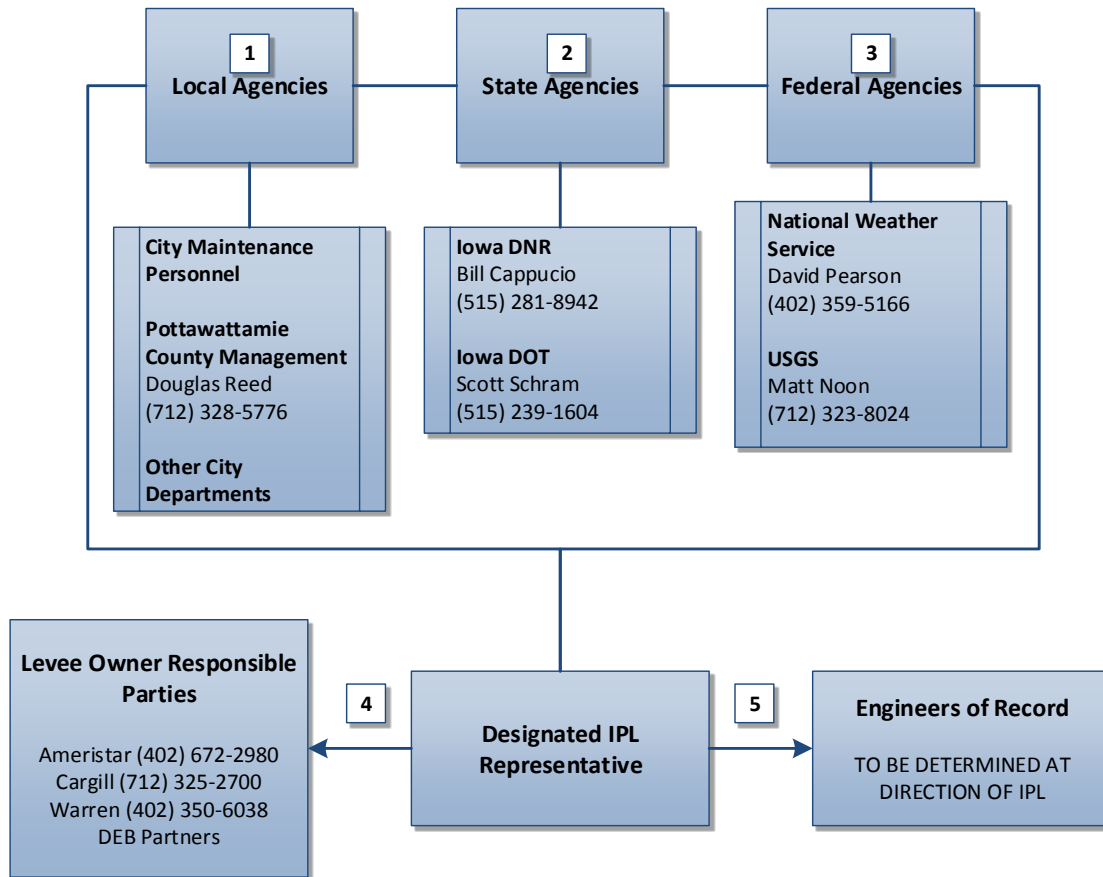
**Figure 3: Unusual Event Notification Flow Chart**



Notes:

1. The IPL Designated Representative will monitor for unusual event notification.
2. The IPL Designated Representative will contact the Engineer if necessary.
3. The IPL Designated Representative will alert the levee owner responsible parties with information on the emergency event, coordination responsibilities and monitoring instructions.

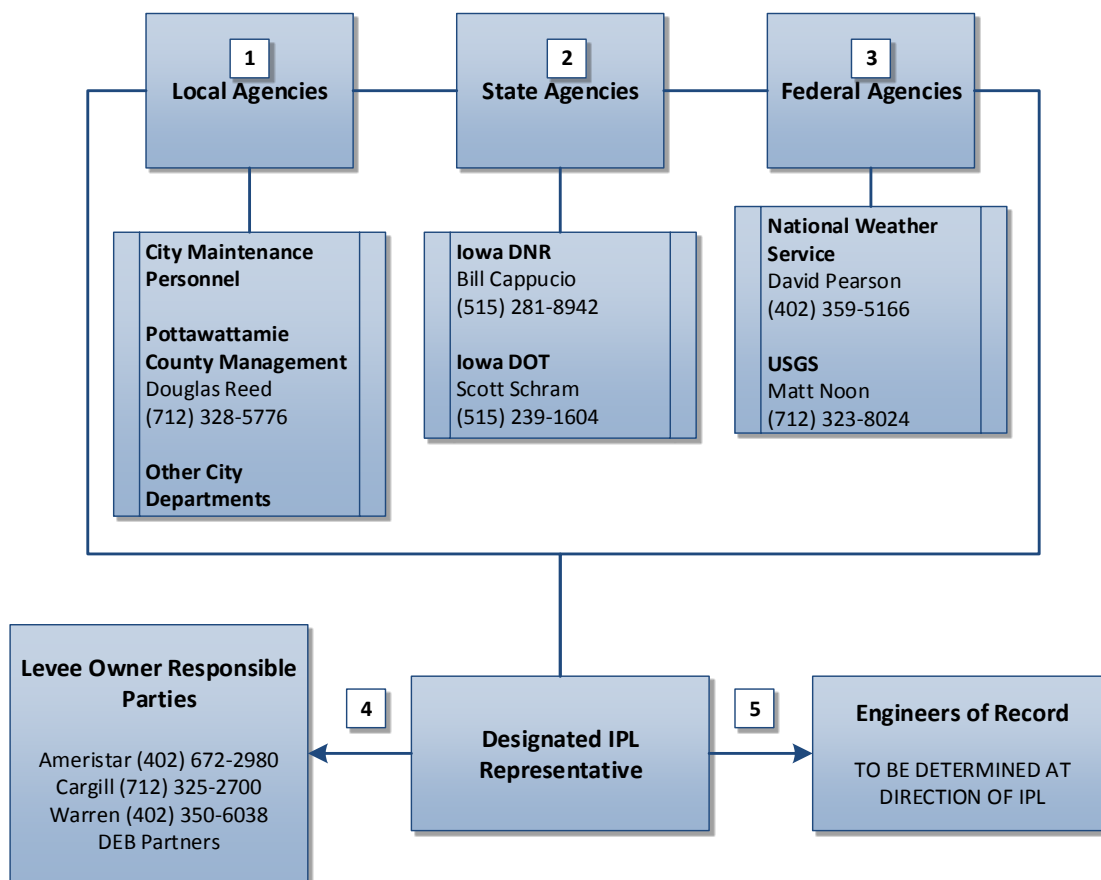
**Figure 4: Watch Event Notification Flow Chart**



**Notes:**

1. The City shall communicate with local agencies with regard to the current situation.
2. The City shall coordinate with state agencies on the event situation, expedited permitting process, and coordination protocol.
3. The City shall coordinate with federal agencies on the event situation, forecasted development, expedited permitting, and coordination protocol.
4. The IPL Designated Representative will alert the levee owner responsible parties with information on the emergency event, coordination responsibilities and monitoring instructions.
5. The IPL Designated Representative will contact the Engineer if necessary.

**Figure 5: Warning Event Notification Flow Chart**



**Notes:**

1. The City shall communicate with local agencies with regard to the current situation.
2. The City shall coordinate with state agencies on the event situation, expedited permitting process, and coordination protocol.
3. The City shall coordinate with federal agencies on the event situation, forecasted development, expedited permitting, and coordination protocol.
4. The IPL Designated Representative will alert the levee owner responsible parties with information on the emergency event, coordination responsibilities and monitoring instructions.
5. The IPL Designated Representative will contact the Engineer if necessary.



### 6.2.2 Supplies

In addition to inspection and maintenance crew supplies outlined in the beginning of Section 6, the following equipment is deemed necessary for patrol of the levee during flood events:

- As-built plans of the levee system
- O&M manual of the IPL
- Appropriate weather clothing and gear

Adequate machinery, instruments, and vehicles will be made available by the Designated IPL Representative to perform the remedial measures required for the proper functioning of the levee during the flood event.

### 6.2.3 Levee

During flood events, the levee shall be patrolled continuously by trained personnel to locate possible sand boils and/or unusual wetness on the landward slope of the levee. Areas immediately riverward of the levee toe shall also be monitored to ascertain that there are no indications of slides and sloughs developing or presence of any scouring action.

Areas of the levee protected by riprap shall be monitored for displaced and/or scoured-out stone. Identified problem areas shall be flagged and remedial action shall be initiated as determined to be necessary to provide continual protection to the levee.

Areas of the levee where approved encroachments are present shall require more detailed inspection and monitoring. These areas shall be monitored for seepage and sand boils at locations where the encroachment penetrates the protected side of the levee, depressions at the levee crest or along the levee slope and increased erosion of the levee embankment near the encroachment. A list of approved encroachments are located in Section 8 and the encroachment locations are also shown on the figures in **Appendix B**.

### 6.2.4 Embankment Protection

Temporary closure measures shall be deployed when the Missouri River reaches the watch level for embankment overtopping identified in **Table 6**. Temporary closure measures for the Boat Slip region of the IPL consist of packing and placing sandbags along the IPL top between levee stationing 247+04 and 248+65. Temporary closure measures shall also be deployed in the levee low area along the ditch section on the northeast side of River Road between levee stationing 252+75 and 253+17. The operations described in detail in Section 6.1.5 shall be followed for deploying temporary closure along the IPL.

The embankment shall be continually inspected for signs of structural distress including piping, erosion, wave wash, cracks, and settlement. The levee embankment shall be maintained to the design grades and section dimensions by replacing any material lost from the crown or the slopes.

Heavy equipment must not be operated on the top of the levee during high flood conditions, except in cases of emergency as determined by the Designated IPL Representative. Operation of heavy loading equipment on the levee can potentially lead to accelerated saturation and over stressing of the embankment.

### 6.2.5 Hydraulic Structures

All interior drainage hydraulic structures will be inspected to keep them clean of debris and obstructions, and assure their proper performance during the flood event. Any ice buildup will be removed to maintain discharge capacity of the culverts.

Culverts penetrating the levee will be inspected for seepage occurring along the outside of the structure and immediate steps will be taken to correct any adverse condition. Flap gates will be

checked for proper closure and any electric or manual gate operators will be monitored to keep them in good working order. If for any reason a hydraulic structure cannot be completely closed by normal means, alternative methods of closing the structure will be evaluated and implemented by the inspection and maintenance personnel.

#### **6.2.6 Channels**

All interior drainage ditches shall be kept clean of all obstructions to flows such as debris and sediment. The water levels in the channels shall be monitored to determine if emergency pumping is required over the top of the levee and into the Missouri River.

#### **6.2.7 Underseepage Control Measures**

Underseepage control measures, such as the underfloor drainage system, toe drains, and relief wells shall be monitored to assess seepage issues within the levee embankment and immediate vicinity. The underfloor drainage system shall be monitored for a failure of the pumps. A significant amount of fine sand or other material observed in the discharge of any underseepage system, or any evidence of sloughing or piping issues shall be reported, a qualified professional engineer licensed in Iowa shall be consulted and immediate remedial measures will be undertaken to address any problems noticed during flooding events.

#### **6.2.8 Access Routes**

All access routes to the levee will be maintained in good working order during a flood event. Surfacing material will be replaced as necessary and any debris blocking movement of vehicles and machinery through the access routes shall be removed to keep the access routes passable.

Inspection and maintenance during a flood event is expected to result in the need to employ temporary measures for flood control purposes. Use of these measures is also expected to delay construction permanent solutions until after the flood event recedes.

**Table 8** on the next page includes typical flood-related levee developments with associated remedial actions.

**Table 8: Typical Levee Remedial Actions**

Typical Event	Recommended Actions
Embankment Overtopping	Place sandbags in the low areas of the top of levee to provide a uniform top of levee.
	Place temporary measures on the top of levee to provide additional freeboard and/or to control wave action from the river. Examples include concrete blocks, Hesco baskets, and sand bags. See Section 6.1.5 for specific temporary closure measures.
	Place erosion-resistant temporary measures along the slope, including riprap, plastic sheeting, sandbags, or other materials.
Seepage and Sand Boils	Pump seepage back into the Missouri River using temporary pumps to control landward flooding.
	If pumping of seepage leads to sand boil activity, ring the sand boils with sand bags to provide more head over the sand boil. When sand boil activity continues to develop, consider suspending pumping operations and letting seepage pond landward of the levee to offset the differential pressure across the levee.
	If seepage continues to develop and leads to excessive sand boil activity that includes the movement of levee material, consider adding emergency underseepage control measures, such as a sand blanket.
	Substructure groundwater pumping and underfloor drainage systems, adjacent to the levee, shall be monitored carefully. Pumping of building substructure groundwater levels that include levee material can lead to the degradation of the levee embankment section. When levee material is being pumped with substructure groundwater, suspend pumping.
Embankment Movement	If a potential levee slide or slump is noticed, carefully monitor for further development and speed with which it develops.
	Repair settlement of the levee crest with sandbags or levee materials to restore the crest width and freeboard.
	If the levee slide or slump is active, provide a soil or rock buttress against the toe of the levee to stabilize the levee slope until a repair can be made post-flood.
Failure at Drainage Structure	If erosion and scouring are noticed near a drainage structure, close the gate associated with the drainage structure crossing and implement temporary pumping. Restore the area with levee material or sand bags and continue to monitor for further development.
	If the erosion and scour around the drainage structure continues to develop, provide plugs for the drainage pipes penetrating the levee.
	If the erosion and scour around the drainage structure continues to develop, look for weaknesses at the connection of the pipe to the structure or other weaknesses within the structure. Backfill with additional levee material or structural fill consisting of a concrete grout mixture or acceptable polymer material. Continue to monitor for further development.
Rodent Holes	Backfill rodent holes with grout or an approved bentonite mixture.
	If rodent holes continue to develop, consider employing a rodent control program in addition to the rodent hole backfilling.
Sabotage or Vandalism	Implement temporary measures to mitigate for levee or structure damage.
	Supplement existing signs with additional warnings and notices about levee access restrictions.
	Implement access control measures to control access to the levee.
	Contact law enforcement personnel if levee damage suffered will endanger public health and safety.

## **6.3 POST-FLOOD OPERATIONS AND MAINTENANCE**

All components of the levee system will be required to be thoroughly inspected immediately following each flood and high water period.

### **6.3.1 Communication**

The Designated IPL Representative will initiate and organize thorough inspection of the levee system by a licensed civil and/or geotechnical engineer after a flood event causing levee damage.

### **6.3.2 Supplies**

Supplies used for temporary measures during flood fighting operations shall be removed and handled properly. Flood water can be contaminated with bacteria, hazardous waste, or biological waste. Therefore, flood fighting supplies that have come in contact with flood water are typically not recommended for reuse. At a minimum, these supplies shall not be reused where they will have human contact. Contact the Council Bluffs Solid Waste Department for specific guidelines governing the disposal of flood fighting materials.

Repair of the levee after the flood shall not be initiated until the Designated IPL Representative or the responsible parties for each property owner have secured all required materials. Supplies may include riprap, filter fabric, levee fill material, sand for sand blankets or underseepage control measures, gaskets or other ancillary materials for the repair of drainage penetrations, and equipment needed for removal of debris, damaged equipment, or restoration of levee slopes.

### **6.3.3 Levee System**

After recession of floodwaters, the Designated IPL Representative will initiate inspection of the entire IPL system by trained inspection and maintenance personnel and the following work will be performed.

- Caves, sloughs, burrows, holes, slips, or other damaged portion of the effective levee cross-section will be repaired immediately.
- Sediment and other deposits along the levee will be removed to return the levee to its designed effective cross-section.
- Trash or debris accumulated along the levee will be cleared.
- Displaced or washed out rock riprap protection and filter bed material will be replaced according to design grade and specifications.
- Any damage to access routes will be repaired and top surface material replaced as necessary to maintain route in good working order.
- The crown of the levee will be inspected for depressions and other damages and repaired.
- Areas within the levee system with damages to vegetation cover will be promptly reseeded to protect against erosion of the levee.
- All debris collected within the interior drainage hydraulic structures will be removed.
- Any loss of grade material or riprap protection at outlet of drainage structures will be replaced and regraded.
- The interior drainage ditch will be inspected to ascertain that there is no loss of discharge capacity due to debris or blockages. All debris and blockages will be promptly cleaned out of the channel.
- Outlet structures will be opened once the water on the river side has receded sufficiently.

- All temporary protection measures (for example, sandbags and material placed during temporary levee raises) will be removed and stored or disposed of.
- An inventory of all remaining flood fight equipment, sandbags, plastic, and other supplies will be taken. Damaged equipment will be repaired or replaced, and flood fighting supplies, such as sandbags or plastic, will be restocked in preparation for the next flood event.
- Entire flood control work will be inspected and recorded, noting locations of damage, indicating areas that were in distress at the time of the flooding, and the extent of damage at each location. This information can serve as a guide for potential problem areas during the next flood event.
- A meeting will be organized between key inspection and maintenance personnel, volunteer representatives, and property owners soon after the event to debrief, share remaining concerns, and to discuss and document lessons learned during the event.
- Recommendations will be provided to the local property owners of any modifications to their emergency preparedness plans that are deemed necessary to account for lessons learned.

Additional maintenance activities and remedial measures may be performed as deemed required by responsible parties to ensure the continued structural integrity and adequate performance of the levee system during future flood events. When a flood event causes levee damage or impacts operation of ancillary facilities, a licensed professional engineer shall be consulted to review the levee condition and recommend levee repairs.

## **SECTION 7 REPORTING REQUIREMENTS**

The following subsections identify the reporting requirements for the IPL.

### **7.1 GENERAL**

Correctly assessing changes that occur over time to the IPL system will require proper reporting and documentation of all the inspection, maintenance, and operations activities performed on the IPL system. Each activity will be thoroughly and accurately documented so that a complete record of the project conditions is available during the life of the IPL system.

### **7.2 REPORTING REQUIREMENTS**

Typical operations and maintenance activities may be approached one of two ways: the City of Council Bluffs can perform all operations and maintenance activities, at a percentage of the expense of the property owners as outlined in the existing easement agreement (Appendix A), or the City and the property owner responsible parties can work collectively to identify, assign, and complete inspection and maintenance activities. All routine, pre- and post-flood inspections and maintenance reports will be prepared by qualified personnel performing the inspection and/or maintenance activities, and filed by either the Designated IPL Representative, or the Property Owner Responsible Parties. Any conditions that will require immediate remedial action will be promptly brought to the notice of the Property Owner Responsible Party and the Designated IPL Representative. If inspection, operations and maintenance activities are completed by individual property owners rather than the City, the Property Owner Responsible Party for each respective property is responsible for annual submission of the inspection, operations, and maintenance reports to the City of Council Bluffs. The City will review each report to verify that each property is meeting the necessary O&M requirements for their respective portions of the levee. Reports may also be compiled collectively by the Property Owner Responsible Parties and submitted to the City of Council Bluffs for a comprehensive review, if desired.

#### **7.2.1 Inspection Reports**

All inspection reports will be prepared by qualified personnel performing the inspection and filed either by each respective Property Owner Responsible Party or the City of Council Bluffs for records. The inspection report will contain:

- IPL project map.
- Date of inspection.
- Name of inspector/s.
- List of all the IPL system features inspected.
- Existing overall condition of the project features.
- Any issues identified that may potentially have an adverse impact on the performance of the IPL system.
- Recommended maintenance to be performed to mitigate the issues identified.

- Photographs of any identified structural or maintenance issues and overall levee area condition.
- Performance of the IPL system during a period of high flood flows after the last inspection.

### **7.2.2 Maintenance Reports**

All maintenance reports will be prepared by qualified personnel performing the inspection and filed either by each respective Property Owner Responsible Party or the City of Council Bluffs for records. The maintenance report will contain:

- Date/s of maintenance activities.
- Name of maintenance personnel.
- IPL system feature/s on which maintenance was completed.
- Any known maintenance work that will be performed in the future.
- Any necessary or recommend maintenance work that may be identified during the course of ongoing maintenance activity.
- Photographs of pre- and post-condition of the system feature/s on which maintenance is performed.
- Areas that will require routine maintenance work will be marked in an IPL system area map and recorded in the maintenance report.
- Conditions that can potentially adversely impact the performance of the IPL system.
- Cost of maintenance incurred for each activity and levee feature.

### **7.2.3 Operations Reports**

All operations reports will be prepared by qualified personnel capable of operation of levee feature/s such as closure structures and filed by responsible parties for each property owner. Operations reports will be prepared during routine and pre- and post-flood inspections and the operations report will contain:

- Date or range of dates of operation.
- Name of operator.
- Any identified issues that may hinder smooth and efficient operation of any levee feature.
- Recommended remedial and maintenance action.
- Performance of the levee feature during high flood conditions.

### **7.2.4 Report Management**

All reports will be prepared and submitted to either the City's Designated IPL Representative or to each Property Owner Responsible Party by qualified personnel within 5 working days of performance of the activity. Electronic versions of the reports including scans of handwritten observations, notes and recommendations, and photographs will be saved by each property owner and shared between fellow IPL property owners. Paper copies of all reports will be stored and maintained in chronological order at an easily accessible location for the relevant personnel entrusted with the responsibility of proper functioning of the IPL system at the offices of each property owner. A copy of the report must also be reviewed by the City of Council Bluffs annually for verification and record of proper inspection, operations, and maintenance activities.



## **SECTION 8 LEVEE ENCROACHMENTS**

### **8.1 DESCRIPTION OF ENCROACHMENTS**

FEMA defines encroachments as the “activities or construction within the floodway including fill, new construction, substantial improvements, and other development”. This includes utility work, boat ramps, and landscaping that could interfere with the functionality and integrity of a FEMA-accredited levee. Encroachments waterward of the levee or adjacent to the levee (on either side) that interfere with the functionality and integrity of the levee or result in changes to WSELs shall not be permitted. Functionality of the levee includes the flood fighting operations required during a high water event on the levee.

### **8.2 MANAGING ENCROACHMENTS**

Industry standards recommend that a levee easement area consist of 15 feet on each side of the levee toe. The easement area shall be free of encroachments. This easement area assists with the performance of levee O&M activities and with flood fight operations.

#### **8.2.1 Identifying Encroachments**

Encroachments are those structures or other obstructions within the project easement that prevent the normal functionality and operation of the levee. Examples of encroachments include: fencing that prevents access across the levee crown, structures within the easement area adjacent to the levee toe, utility poles within the embankment, and unknown penetrations built through the levee.

**Table 9** on the following page identifies the existing acceptable encroachments within the IPL and their approximate stationing. Encroachments can be viewed in **Appendix B** figures.

#### **8.2.2 Communications Plan**

All responsible parties for each property owner shall remain in communication with regard to the management of the IPL. Future development in the area of the IPL shall be coordinated with all property owners and the City to ensure that future development does not hinder IPL operations and maintenance or flood fighting operations.

#### **8.2.3 Approval Procedures**

Any future development within or adjacent to the IPL shall be coordinated between the property owners and the City. As the official IPL development approval process through the City is developed, this section of the O&M manual shall be updated accordingly. A list of approved encroachments is included below. Any additional encroachments approved by a qualified engineer shall be added to the approved encroachments list.

**Table 9** on the next page identifies acceptable existing encroachments within the IPL alignment. Encroachments can be found on **Appendix B** figures.

**Table 9: Existing IPL Encroachments**

Encroachment ID	Approximate Levee Stationing	Encroachment Description
E1	204+25 to 211+00	6" Chain Link Fence
E2	212+00 to 213+45	Warren Building
E3	216+00 to 222+25	Rail Spur
E4	218+50 to 222+25	Rail Spur
E5	224+45	Rail Spur and Rail Stop
E6	226+50 to 231+25	Cargill Roadway
E7	233+00	Divisional Marker (River Warning Sign)
E8	236+50	Electric Manhole #5
E9	237+70	Drainage Structure and Block Wall Located Between Hotel and Levee Road
E10	238+25 to 241+75	Holiday Inn, Including Patio and Roof Drains
E11	238+50 to 244+50	Ornamental Fence and Chain Link Fence Along Levee Crest
E12	242+20	Electric Manhole #6
E13	242+20 to 243+75	Underground Electric
E14	243+85 to 244+35	Concrete Block Electric Enclosure
E15	243+95 to 245+35	Underground Electric
E16	244+25 to 247+70	Sheet Pile Wall
E17	244+30 to 245+40	Underground Electric
E18	244+35 to 248+25	Ameristar Hotel
E19	245+15	Roof Drains for Ameristar Hotel
E20	245+20 to 245+45	3" Watermain
E21	245+ 22 to 245+50	4" Sanitary
E22	245+32 to 245+52	Drainage Trench at riverside levee toe
E23	246+10 to 246+30	Roof Drains on river side slope
E24	244+35 to 248+25	Ameristar Atrium
E25	247+80 to 250+40	2 Roof Drain Manholes and Pipe Along the Centerline of Levee
E26	248+00 to 249+70	Underground Electric for Parking Area
E27	248+00 to 248+15	Stairs on Protect Side of Levee Slope
E28	248+95	Manhole on Protected Side Slope
E29	249+63 to 249+66	Stairs on Protect Side of Levee Slope
E30	249+69 to 249+79	Waterline and Fire Hydrant for Riverboat.
E31	250+40	Storm Sewer from Centerline of Levee to Levee Toe on Protect Side.
E32	251+75	Levee Traffic Gate
E33	251+85	Underground Electric
E34	252+05	Underground Electric

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## **ATTACHMENT A – AGREEMENTS**

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### **1982 Levee Maintenance Agreement Updated 2011 Assessment Schedule**

In 1982, the parties located within the industrial park agreed to enter into joint levee project to protect their properties located along the Missouri River. Each of the landowners within the project agreed to grant the City of Council Bluffs a perpetual easement to construct and maintain a levee on their properties.

The area subject to the 1982 Levee Maintenance Agreement and Easement (“Agreement”) was divided into ten parcels, and each parcel was accorded a percentage of the completion cost. *See Exhibit B*. The rationale behind the allocation of the cost is unclear, and there is no reference in the Agreement as to how the numbers were reached. However, what is clear is that the Agreement requires that landowners and their successors “shall pay such cost of repairs and maintenance in accordance with the percentages set forth in ... Exhibit B.” *Levee Maintenance Agreement and Easement (Agreement)* p. 3.

The Agreement states that any landowner who divides one of the properties shall allocate a percentage of the amount carried by the property to the subdivided property in accordance with §455.56 of the Iowa Code (now codified 468.49). *Agreement* p. 3. The original ten properties have changed hands over time, and there is no evidence that the property owners filed any documents appropriate to meet the requirements of §468.49 upon the transfer of the property with the recording office. Therefore, the City has reviewed the property transactions after the fact and thereby allocated the cost of repairs to the 2011 owners.

### **CALCULATING BASE ACRES AT TIME OF AGREEMENT**

Attached to the Agreement are detailed descriptions of the properties made party to the Agreement, only some of which contain the size of the parcel in acres, making it impossible to retrospectively allocate the percentage due when the property is subsequently subdivided. Therefore, it is necessary to find an “original acreage basis” for each parcel identified in the Agreement, and thereby

allocate away from the “original base acres” the subsequently subdivided acres in the transferring deeds.

The acreage allocated to each parcel within the levee varies greatly depending year and site plan. Therefore, the City has chosen the 1980 HDR map to provide the baseline acreage numbers for the tabulation of percentage of allocation for transfers after the Agreement based their similarity to the corresponding parcels in the 1980 HDR site plan (see below), and because of the contemporaneous nature of the Agreement’s creation and the 1980 HDR map.

<b>Exhibit A of Agreement</b>	<b>1980 HDR Site Plan Map Acreage</b>
	19.6
	18.6
	1.73
3.937 acres	3.9
	2.1
	2.1
	10.1
	13.8 + 9.3 = 23.1
2.2 acres	2.2
3.872 acres	3.9
69.1 acres	69.1
0.78 acres	0.8

(\*Note that not all of the acreage numbers were included in the Agreement descriptions.)

It should be noted that whichever parcel map is selected to provide the original base acres will produce the same percentage allocation per parcel, because the percent of allocation in the original Agreement bore no relation to the size of the parcel. Rather, it is the accurate determination of the acres that are subdivided away from the parcel that will assure an accurate allocation of the percentage due transfer between the parcel owners.

## **SUBDIVIDED PARCELS 1980 TO 2011**

The accurate calculation of parcel percentage using the 1980 HDR Site Plan requires not only the inclusion of property transactions subsequent to the Agreement, it also requires the inclusion property

transactions prior to the Agreement, but after the 1980 HDR map was completed. Therefore, the City began its analysis from 1980 forward.

	Subdivision of Parcels
Parcel 1	5/22/1981 Cargill to Warren (1.665 acres) & 5/6/1985 Cargill to Warren (1.517 acres)
Parcel 2	None
Parcel 3	None
Parcel 4	None
Parcel 5	None
Parcel 6	None
Parcel 7	None
Parcel 8	None
Parcel 9	None
Parcel 10	None
Parcel 11	D.E.B. (49.7 acres) and Warren (19.14 acres)
Parcel 12	None

## 2011 OWNERSHIP AND PERCENTAGES

The City's analysis of title search has resulted in the following allocation of property. Properties transferred, but not subdivided are listed under their current ownership.

Parcel #	1980%	1980 Acres	2011 Acres	2011 Owners	2011 Percentages
1	27.58	19.6	$(19.6 + 18.6 = 38.2) - 1.665 - 1.517 = 35.018$	Cargill	32.43%
2	9.33	18.6			
3	0.71	1.73	$9.83 + 2.2 + 1.666 + 1.517 = 15.212$	Warren "West"	11.22%
4	3.67	2.1			
5	0.88	2.1			
6	1.43	3.9	33.2	Ameristar	33.50%
7	6.32	10.1			
8	27.18	23.1	2.2	Added to Warren "West"	
9	0.06	2.2	3.9		
10	0.2	3.9	49.7 & 19.14	D.E.B. & Warren "East"	D.E.B. = 16.1028% & Warren = 6.4%
11	22.39	69.1	2.393	Allocated to whole	
12	0.25	0.8			0.25% (+ 0.0902% unknown)

The City's calculation allocated 99.9098% of the 1980 burden to the current 2011 owners, although some of the burden was left unassignable (0.0902%). The most likely cause for the discrepancy is the City's right-of-way improvements within the industrial park. Parcel 12 has also been subsumed by the I-29 ramp, which now located within the industrial park. In accordance with the Agreement and §468.49 of the Iowa Code the unassignable percentages were totaled and divided among the property holders now of record. *Agreement* p.3. Therefore, based on the property transactions to date the

current percentages per owner in 2011 are: Ameristar 33.585%; Cargill 32.515%; D.E.B. 16.1878%;  
Warren Distribution 17.7122%.

**IPL INTERIOR 1-PERCENT ANNUAL CHANCE FLOOD BOUNDARIES**

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## Industrial Park Levee Interior Flood Boundaries

● Outfalls

1% Annual Chance Water Surface Extents\*

0 250 500  
Feet



\* Water surface extents are labeled with calculated water surface elevations for the 1-percent annual chance event and are in the North American Vertical Datum of 1988.

Ameristar Roof Drain North

Ameristar Roof Drain South

Ameristar Outfall

River Road Outfall

Warren Outfall

Cargill Outfall

977.4

975.5

973.2

I-29

973.2

973.2

973.5

975.5

973.2

973.2

973.2

I-80

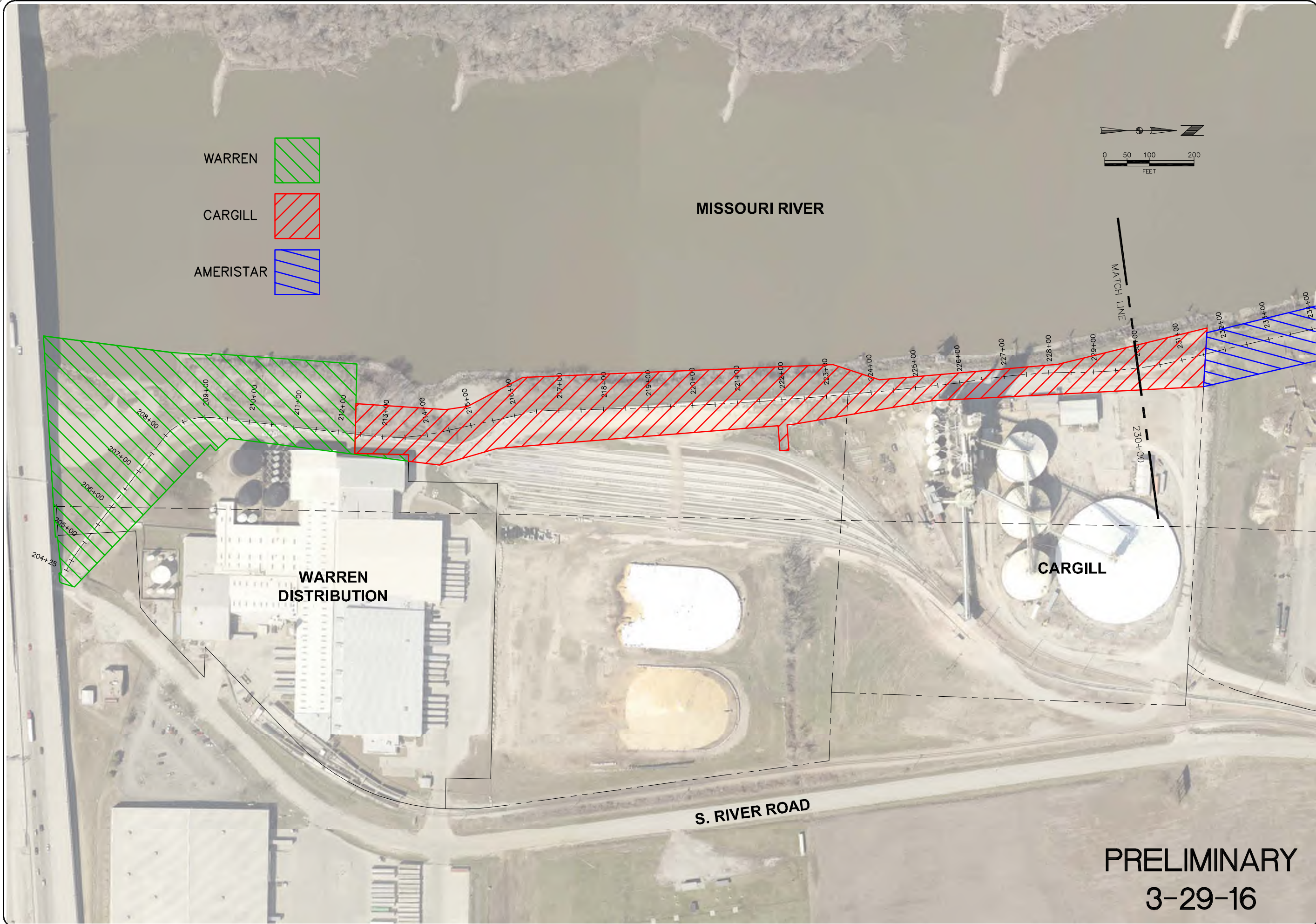


## **DRAFT REVISED INDUSTRIAL PARK LEVEE EASEMENTS**



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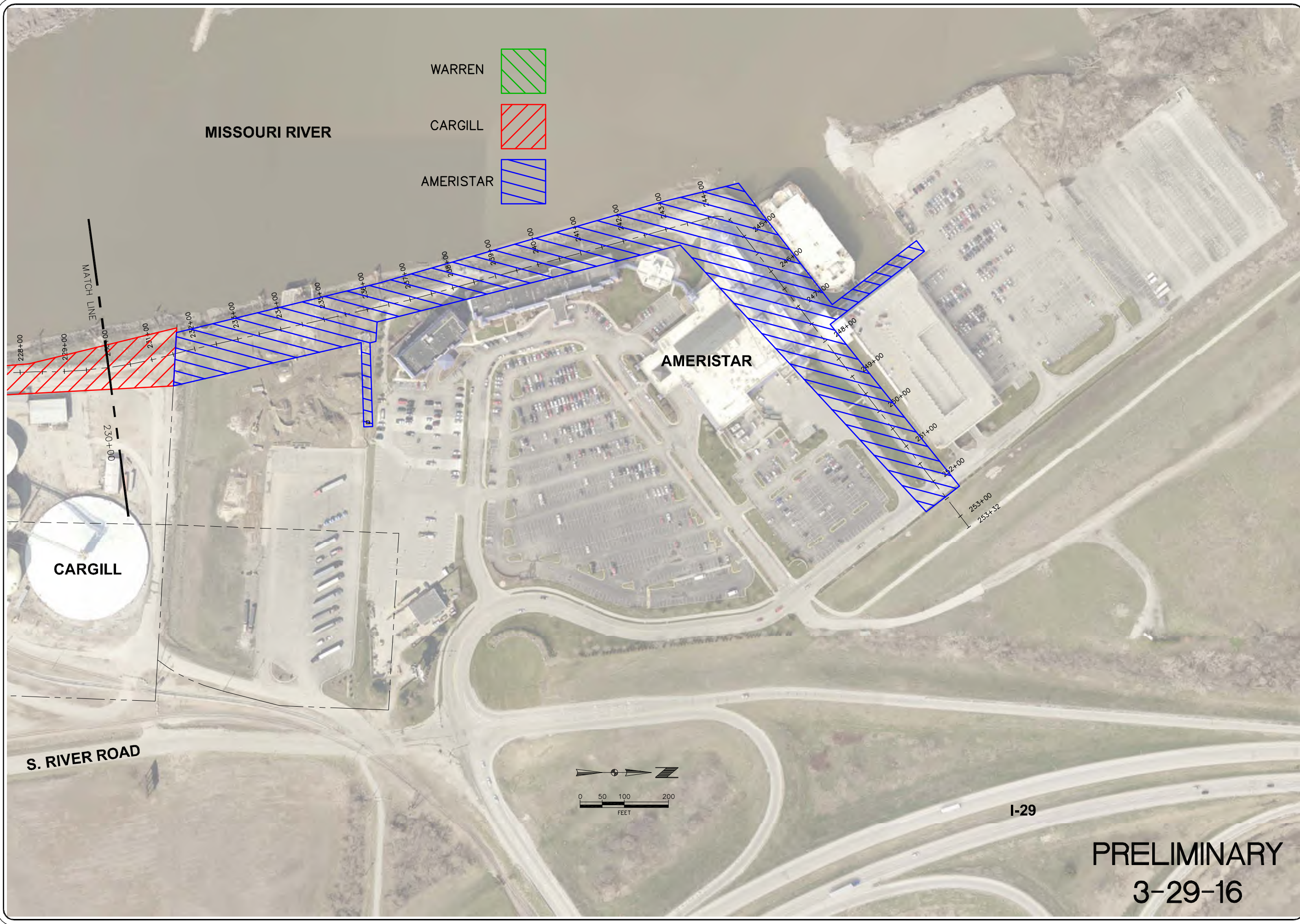
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3-29-16

project INDUSTRIAL PARK LEVEE IMPROVEMENTS  
PHASE II  
client CITY OF COUNCIL BLUFFS  
COUNCIL BLUFFS, IOWA  
sheet PERMANENT EASEMENT EXHIBIT

BCL	drawn	date
ZMW	designed	revision
JLO	approved	date
MAR '16		



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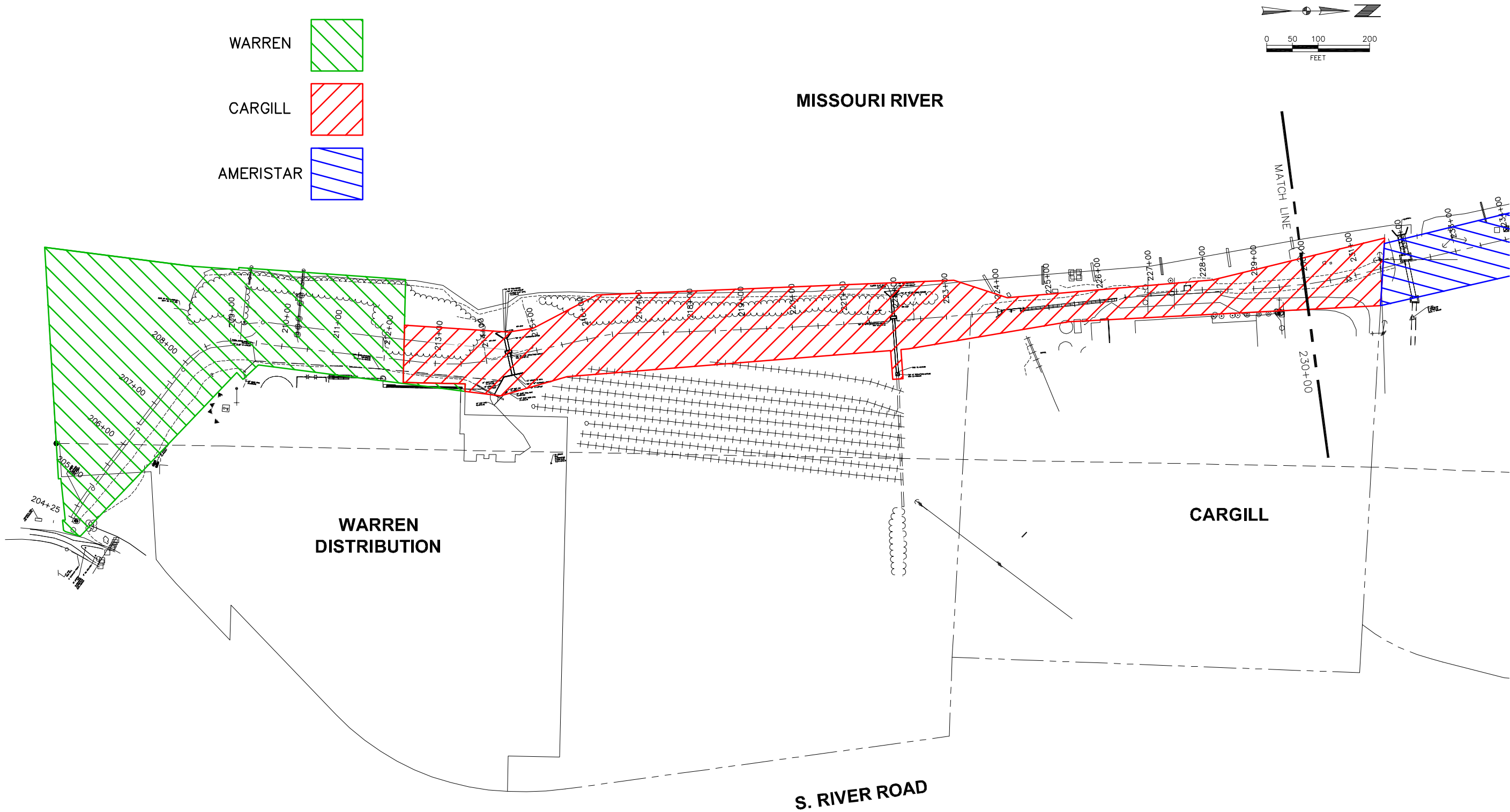
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client	CITY OF COUNCIL BLUFFS COUNCIL BLUFFS, IOWA
sheet	PERMANENT EASEMENT EXHIBIT

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ZMW	designed	revision
JLO	approved	date
MAR '16		

project no.	106415
sheet	2 OF 2



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PHASE II

client CITY OF COUNCIL BLUFFS  
COUNCIL BLUFFS, IOWA

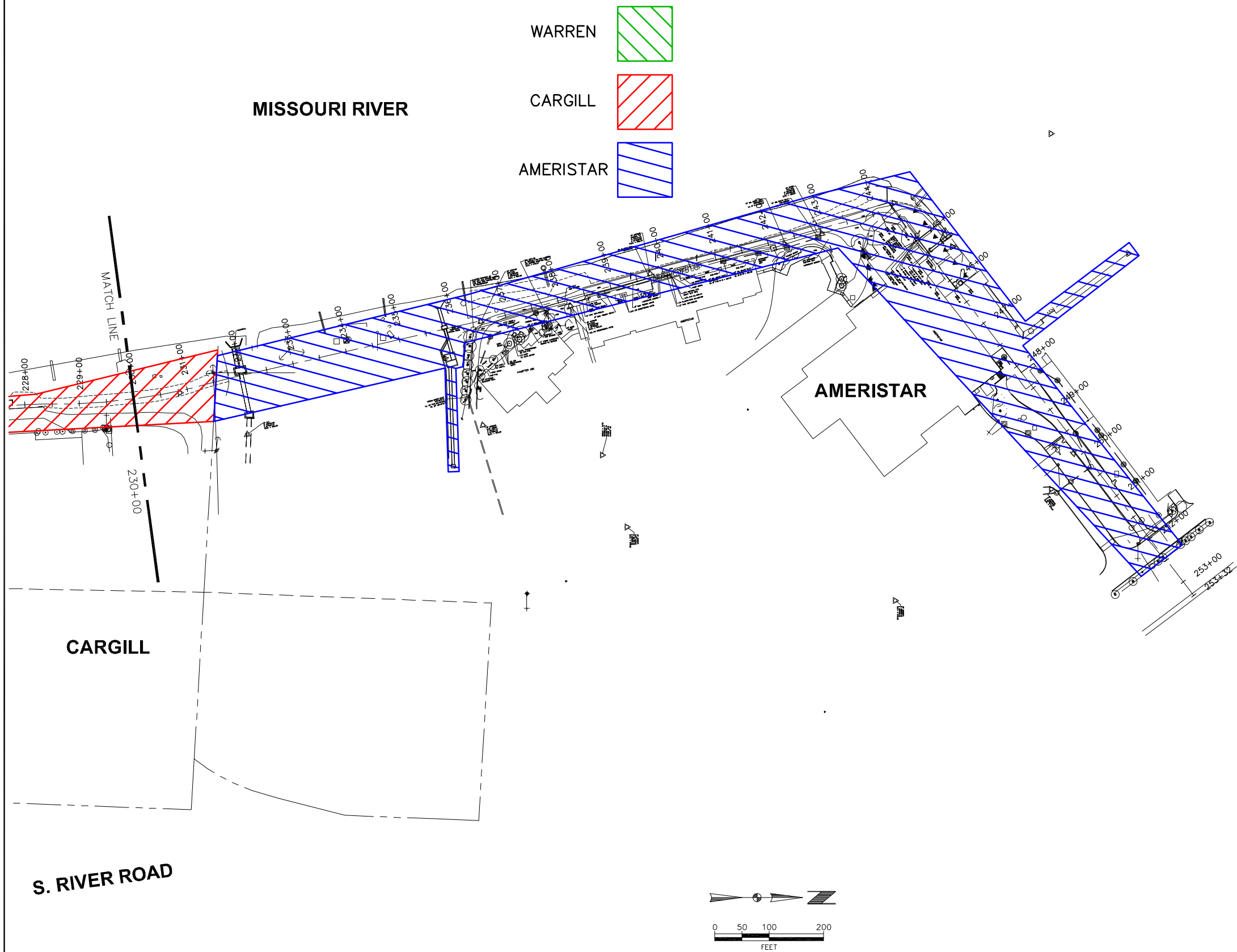
sheet PERMANENT EASEMENT EXHIBIT

BCL	drawn	date
ZMW	designed	revision
JLO	approved	date
MAR '16	date	revision

project no.  
106415

sheet  
1 OF 2

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I-29

PRELIMINARY  
3-29-16

project INDUSTRIAL PARK LEVEE IMPROVEMENTS  
PHASE II  
client CITY OF COUNCIL BLUFFS  
COUNCIL BLUFFS, IOWA  
sheet PERMANENT EASEMENT EXHIBIT

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JLO  
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MAR '16  
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project no.  
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hgm  
ASSOCIATES INC.  
CDM  
Smith

**1982 LEVEE AGREEMENT – INCLUDED FOR REFERENCE ONLY**

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6192

STATE OF IOWA, Polk County  
Filed for record the 19 day of December  
1982 at 9:30 o'clock A. M. and recorded  
in book 84 page 11239

LEVEE MAINTENANCE AGREEMENT AND EASEMENT

By John Sciorino Recorder

THIS AGREEMENT, made this 7<sup>th</sup> day of December, 1982, by and between FARMLAND INDUSTRIES, INC., a Kansas corporation, COUNCIL BLUFFS INDUSTRIAL FOUNDATION, INC., an Iowa corporation, CARGILL, INC., a Delaware corporation, WARREN OIL COMPANY, a Nebraska corporation, ROBERT N. SCHLOTT and BARBARA SCHLOTT, husband and wife, THELMA J. SCHLOTT, single, as devisee under Will of NORMAN P. SCHLOTT, deceased, EUGENE R. SEVERS and BARBARA J. SEVERS, husband and wife, (all collectively referred to hereinafter as "LANDOWNERS") and THE CITY OF COUNCIL BLUFFS, IOWA, and in consideration of the mutual covenants and agreements hereinafter stated, it is hereby

AGREED, as follows:

1. Each of the landowners own certain property which is affected by a joint levee project and the list of the property owners and a description of the property of each is attached hereto and made a part hereof and referred to as Exhibit "A". Each landowner warrants to each other landowner herein that the land is owned as stated in Exhibit "A" and each warrants to each other to defend the title of each landowner's own land as against all title claims of other persons and will hold harmless the other landowners from any such claims as may in any way jeopardize the terms and conditions of this agreement.

2. Each landowner grants to one another and to the City of Council Bluffs, Iowa, and does hereby bargain, sell, transfer and convey unto one another and to the City of Council Bluffs a perpetual easement with the right to operate, inspect, repair, maintain, and replace the existing levee at its present location for the purpose of protecting the subject lands of the landowners from the flooding of the Missouri River. All of the land of the landowners upon which the levee is situated which is included in the land as described in Exhibit "A" shall be subject to this grant of



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right by each of the landowners and this agreement shall be binding upon the successors, assigns, and heirs of the landowners. Each landowner grants to one another and to the City of Council Bluffs the reasonable right of ingress and egress over, across and through adjacent lands of the landowners to the actual land upon which the levee is situated as may be reasonably necessary for the purpose of this levee maintenance agreement and in exercising such access, the landowners and the City of Council Bluffs shall not unreasonably interfere with any existing business operations then taking place; provided, however, that all parties mutually understand that such adjacent lands are for the purpose of development and this agreement shall not be construed by anyone as preventing or diminishing the right of landowners to construct substantial improvements upon the adjacent lands.

3. Each landowner grants to the City of Council Bluffs, Iowa, the right to enter upon the lands described in Exhibit "A" for the purpose of reasonable inspection at reasonable times and circumstances to fully inspect, test, and monitor the levee which has been erected and the City of Council Bluffs, Iowa, in exercising such access, shall not unreasonably interfere with any existing business operations then taking place. The City of Council Bluffs agrees to inspect, monitor, and test the levee for the purposes of this agreement.

4. Landowners shall pay all the reasonable costs of repairs and maintenance of the levee and agree to promptly pay within sixty days any costs of repairs and maintenance as reasonably required by the City of Council Bluffs which may be reasonably required and assessed in accordance with the terms and conditions of this agreement and as specified by Chapter 455 of the Code of Iowa, and as amended from time to time, and the landowners shall pay such costs of repairs and maintenance in accordance with the percentages set forth in

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the attached Exhibit "B", which are the same percentages by which the original cost of the levee was shared by landowners pursuant to the final assessment schedule for the 1980 Industrial Levee Project. These percentages as set forth in Exhibit "B" can never be modified, except upon prior written consent by all parties. For the purposes of Chapter 455 of the Code of Iowa these percentages as set forth in Exhibit "B" shall be deemed by all parties as the classification of benefits. Any landowner who may divide any parcel of land described in Exhibit "A" into two or more separate tracts shall file in the Recorder's Office of Pottawattamie County, Iowa, and with the Office of Clerk of City of Council Bluffs, Iowa, the apportionment of the percentage stated herein in accordance with §455.56 of the Code of Iowa.

5. Landowners authorize the City of Council Bluffs, Iowa, to maintain the levee and to agree to abide by the reasonable orders of the City of Council Bluffs with regard to the maintenance of the levee, which maintenance shall comply with Chapter 455 of the Code of Iowa as now existing or hereafter amended. In this regard, it is the intent of the parties that the City of Council Bluffs, Iowa, shall have the authority, the duty, and right to proceed as a board of trustees of a levee or drainage district in accordance with the procedures as prescribed in Chapter 455 of the Code of Iowa as now existing or as hereafter amended, and, specifically, as though this was a district established by mutual agreement in accordance with §455.152-.155 of the Code of Iowa. All grants of power by the landowners to the City of Council Bluffs, Iowa, pursuant to this agreement shall be limited by any rights normally retained by landowners under Chapter 455 of the Code of Iowa as now existing or as hereafter amended. Should any dispute ever arise by and between the parties, Chapter 455 of the Code of Iowa shall govern the matter of the resolution of such dispute and all parties to this agreement shall be bound by the terms of

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Chapter 455 of the Code of Iowa, the same as if the City of Council Bluffs, Iowa, acting through its city council, was the board of trustees and the landowners in this agreement were landowners in a drainage or levee district operating under the terms and circumstances of a levee or drainage district imposed under Chapter 455, Code of Iowa.

6. Commencing with the date upon which the Levee maintenance agreement has been executed by all parties hereto, the landowners agree to indemnify and hold harmless the City of Council Bluffs, Iowa, with regard to all claims made against the City of Council Bluffs, Iowa, for damages or injury, which claims shall be limited to those which arise from an act or failure to act by the City of Council Bluffs, Iowa, when performing within the terms and conditions of this levee maintenance agreement. This indemnity and hold harmless by the landowners to the City of Council bluffs, Iowa, shall be limited to ordinary negligence and ordinary breach of contract and shall not include gross negligence or intentional damages or injury caused by the City of Council Bluffs, Iowa. Any such claims paid by the landowners shall be in accordance with percentages to each as set forth in the attached Exhibit "B". At any time the City of Council Bluffs, Iowa, invokes this paragraph, it must timely notify in writing all then existing landowners and thereafter the landowners shall have the right to appoint legal counsel of their choice to defend at landowner's expenses any such claim or action as described in this paragraph. Any liability by each of the landowners herein is several and not joint and no landowner shall be held responsible for any expenses or liabilities under the terms of this Agreement except to the extent of the individual percentages of each as set forth in the attached Exhibit "B".

7. Certain landowners, as listed and described in Exhibit "C" attached hereto, have added their own special improvements as described in Exhibit "C", and have paid all

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costs and expenses for the construction of such improvements. Inasmuch as said special improvements are integral to the levee and must, therefore, be maintained and function properly in order to provide the protection for which the levee was designed and built, said landowners described in Exhibit "C" agree to operate and maintain their respective special improvements, as described in Exhibit "C", in a prudent manner and in accordance with reasonable directives and orders which shall relate only to the reasonable repairs and maintenance of the levee and which may from time to time be issued by the city manager or public works director of the City of Council Bluffs, Iowa. Said landowners do further agree that, in any event, the City of Council Bluffs may, in its reasonable discretion enter upon such special improvement property and operate and/or maintain said special improvements in the manner the City of Council Bluffs deems reasonably necessary. Any future maintenance or repairs of such special improvements which are reasonably made or requested by the City and which are reasonably necessary shall be paid entirely by the landowners upon whose property said improvement lies, as identified in Exhibit "C" hereto. All rights retained by landowners in paragraphs 4 and 5 of this Agreement with regard to the provisions of Chapter 455 of the Code of Iowa, as now existing or as hereafter amended, are also retained as to any special improvements by the certain landowners described in Exhibit "C".

8. This constitutes the whole, complete and entire agreement by and between the parties and this agreement cannot be altered, amended, modified, or revoked except upon the consent of all of the parties hereto in writing and, additionally, the consent of the Iowa Natural Resources Council of the State of Iowa.

9. This agreement is binding upon the heirs, assigns and successors in interest of the parties and shall

# COMPARED

constitute a covenant that runs with the lands as legally described in Exhibit "A".

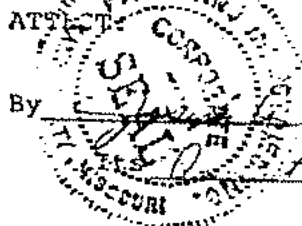
FARMLAND INDUSTRIES, INC., a  
Kansas Corporation

(SEAL)

By E. L. Francis

Its Treasurer

WJP



By James A. Carter  
Its Secretary

COUNCIL BLUFFS INDUSTRIAL FOUNDATION,  
INC., an Iowa Corporation

(SEAL)

By James A. Carter

Its President



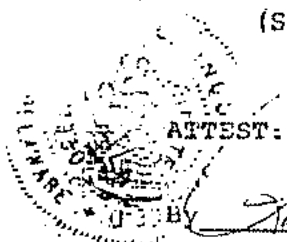
By James A. Carter  
Its Secretary

CARGILL, INC., a Delaware Corporation

(SEAL)

By Harold H. Hixson

Its President



By Harold H. Hixson  
Its President

WARREN OIL COMPANY, a Nebraska  
Corporation



By James M. Pearson

Its President

By James M. Pearson

Its Executive Vice President

# COMPARED

Robert N. Schlott  
ROBERT N. SCHLOTT

Barbara A. Schlott  
BARBARA SCHLOTT

Husband and Wife

Thelma J. Schlott  
THELMA J. SCHLOTT, single, Devisee  
under Will of Norman P. Schlott,  
Deceased

Eugene R. Severs  
EUGENE R. SEVERS

Barbara J. Severs  
BARBARA J. SEVERS

Husband and Wife

"LANDOWNERS"

THE CITY OF COUNCIL BLUFFS, IOWA

By Willie A. Hollen  
Its Mayor



By Edgar J. Hollen  
Its Clerk

STATE OF KANSAS )  
COUNTY OF Clay ) ss.

On this 7<sup>th</sup> day of December, A.D. 1982,  
before me, the undersigned, a Notary Public in and for the  
State of Kansas, personally appeared E. L. Harrison  
and Joseph A. Critch, to me personally known, who  
being by me duly sworn, did say that they are the  
Harrison and Assistant Secretary  
respectively of Farmland Industries, Inc., executing the  
within and foregoing instrument to which this is attached,  
that ~~(no seal has been procured by the said)~~ (the seal  
affixed thereto is the seal of said) corporation; that said  
instrument was signed (and sealed) on behalf of said  
corporation by authority of its Board of Directors; and that

## COMPARED

### PARCEL 1:

A part of Government Lot 4 in the SW<sup>1</sup>, SE<sup>1</sup> and NE<sup>1</sup>, SW<sup>1</sup> of Section 4, Township 74, Range 43 in the City of Council Bluffs, Pottawattamie County, Iowa, which is more particularly described as follows: Commencing at the South E corner of said Section 4; thence S 89° 44' 10" W, 347.68 feet; thence N 02° 32' 15" E, 345.42 feet to a point of beginning; thence N 02° 32' 15" E, 82.23 feet; thence N 00° 55' 10" E, 390.70 feet; thence N 03° 17' 30" W, 500.19 feet; thence N 06° 12' 30" W, 131.23 feet; thence along the existing southerly property line of the Cargill Company, S 88° 19' 45" E 335.53 feet and S 88° 16' 05" E, 399.97 feet; thence S 89° 18' 15" E, 153.37 feet; thence S, 09° 18' 15" E 782.28 feet; thence southeasterly 82.69 feet on a 485.91 foot radius curve to the right; thence S 89° 44' 10" W 729.45 feet; thence S 00° 15' 50" E 100.00 feet; thence S 89° 44' 10" W, 60.00 feet; thence S 00° 15' 50" E, 120.00 feet; thence S 89° 44' 10" W, 200.00 feet to point of beginning.

NOTE: The South line of said Government Lot 4 is assumed to bear S 89° 44' 10" W.

OWNER: Cargill, Inc.

EXHIBIT "A"  
Page 1 of 17

## ✓ COMPARED

*Posted to pts of NWSE, SWSE, NESW & SESW 1/4  
H. 74-44*

PARCEL 2:

Commencing at the center point of Section 4, Township 74, Range 44, Pottawattamie County, Iowa; thence Southerly along the North-South Center line of said Section 4, five hundred twenty-eight (528) feet to (the point of beginning; thence easterly parallel to the East-West center line of said Section 4, four hundred (400) feet; thence southerly seven hundred ninety-two (792) feet parallel to the North-South center line of said Section 4; thence Westerly parallel to the East-West center line of said Section 4, seven hundred thirty-two and two tenths (732.2) feet to the East or left bank of the Missouri River; thence Northerly along the left bank of the Missouri River to a point five hundred twenty-eight (528) feet south of the East-West center line of said Section 4 and four hundred (400) feet West of the point of beginning; thence east four hundred (400) feet to the point of beginning.)

OWNER: Cargill, Inc.

EXHIBIT "A"  
Page 2 of 17



## COMPARED

PARCEL 3:

✓ A part of Government Lot 4 in the SW  $\frac{1}{4}$  SE  $\frac{1}{4}$  and SE  $\frac{1}{4}$  SW  $\frac{1}{4}$  of Section 4, Township 74 North, Range 44 West of the 5th Principal Meridian, Pottawattamie County, Iowa, in the City of Council Bluffs which is more particularly described as follows:

Commencing at the South  $\frac{1}{4}$  corner of said Section 4, thence S  $89^{\circ} 44' 10''$  W. 357.68 feet; thence N  $02^{\circ} 32' 15''$  E. 345.42 feet; thence N  $89^{\circ} 44' 10''$  E. 200.00 feet; thence E  $00^{\circ} 15' 50''$  W. 120.00 feet; thence N  $89^{\circ} 44' 10''$  E. 60.00 feet to the point of beginning; thence N  $00^{\circ} 15' 50''$  W 100.00 feet; thence N  $89^{\circ} 44' 10''$  E. 729.45 feet; thence southwesterly 100.87 feet along a 484.96 foot radius curve to the right; thence S  $89^{\circ} 44' 10''$  W. 717.66 feet to the point of beginning.

NOTE: The East line of said Government Lot 4 is assumed to bear due North and South.

OWNER: Warren Oil Company

EXHIBIT "A"  
Page 3 of 17

## COMPARED

### PARCEL 4:

A part of the SE $\frac{1}{4}$  SW $\frac{1}{4}$  and a part of the SW $\frac{1}{4}$  SE $\frac{1}{4}$ , all in Section 4, Township 74, Range 44, Pottawattomie County, Iowa, being more particularly described as follows: Commencing at the SE $\frac{1}{4}$  corner of said Section 4: thence South 89° 44' 10" West, 357.68 feet along the South line of said Section 4 to the top of piling line as established from Corps of Engineers Drawing Numbers M400/38 and M400/39 dated May, 1969; thence North 2° 32' 15" East, 20.03 feet along said top of piling line to the point of beginning; thence continuing along said top of piling North 2° 32' 15" East, 225.27 feet; thence North 89° 44' 10" East, 868.00 feet to the Westerly line of a 48' railroad easement; thence continuing along the Westerly line of said railroad easement Southwesterly 22.41 feet along a 484.96 foot radius curve to the right whose chord bearing and distance is South 43° 04' 55" West, 22.41 feet; thence continuing along the Westerly line of said railroad easement South 44° 39' 45" West, 294.86 feet to the North line of a 20' sanitary sewer easement; thence continuing along the North line of said sanitary sewer easement South 89° 44' 10" West, 655.33 feet to the point of beginning. Said parcel contains 171,488 square feet of 3.937 acres more or less.

NOTE: The south line of said Section 4 is assumed to bear South 89° 44' 10" West.

OWNER: Robert N. Schlott

EXHIBIT "A"  
Page 4 of 17

## COMPARED

### PARCEL 5:

A part of Government Lot 4 in the SW $\frac{1}{4}$ , SE $\frac{1}{4}$  and SE $\frac{1}{4}$  SW $\frac{1}{4}$  of Section 4, Township 74 North, Range 44 West of the 5th Principal Meridian, Pottawattamie County, Iowa, in the City of Council Bluffs which is more particularly described as follows:

Commencing at the South  $\frac{1}{2}$  corner of said Section 4, thence S 89° 44' 10" W, 357.68 feet; thence N 02° 32' 15" E, 345.42 feet; thence E 89° 44' 10" E, 200.00 feet to the point of beginning; thence N 00° 15' 50"W, 120.00 feet; thence N 89° 44' 10" E, 777.66 feet to a point at which tangent to a curve bears S 12° 22' 50"W, thence southwesterly 128.29 feet along a 484.96 foot radius curve to the right; thence S 89° 44' 10" W, 733.36 feet to the point of beginning.

NOTE: The East line of said Government Lot 4 is assumed to bear due North and South.

OWNER: Thelma J. Scullott

EXHIBIT "A"  
Page 5 of 17

## COMPARED

### PARCEL 6:

A part of the SE $\frac{1}{4}$  SE $\frac{1}{4}$  and a part of the SW $\frac{1}{4}$  SE $\frac{1}{4}$  all in Section 4, T74N, R44W of the 5th P.M., Pottawattomie County, Iowa being more particularly described as follows:

Commencing at the SE corner of said Sec. 4; thence S 89° 44' 10" W, 357.68 feet along the south line of said Sec. 4 to the top of piling line as established from Corps of Engineers drawing #N 400/38 and #N 400/39, dated May, 1969; thence N 2° 32' 15" E, 245.30 feet along said top of piling line to the Point-of-Beginning; thence continuing along said top of piling line N 2° 32' 15" E, 100.17 feet; thence N 89° 44' 10" E, 933.36 feet to the Westerly line of a 48 foot railroad easement; thence continuing along the Westerly line of said railroad easement, Southwesterly 122.54 feet along a 464.96 foot radius curve to the right whose chord bearing and distance are S 34° 49' 19" W, 122.21 feet; thence S 89° 44' 10" W, 868.00 feet to the Point-of-Beginning.

NOTE: The south line of said Section 4 is assumed to bear S 89° 44' 10" W.

OWNER: Thelma J. Schlott

EXHIBIT "A"  
Page 6 of 17

## COMPARED

PARCEL 7:

A part of Government Lot Three (3), Section Four (4), Township Seventy-Four (74) North, Range Forty-Four (44) West, of the Fifth (5th) PM, Pottawattamie County Iowa, in the City of Council Bluffs, which is more particularly described as follows: Commencing at the East Quarter (E $\frac{1}{4}$ ) corner of said Section Four (4) which is the Northeast corner of said Government Lot Three (3); thence along the North line of Government Lot Three (3), N. 88° 08' 15" W., 2663.40 feet to the center of said Section Four (4); thence S 00° 41' 45" W., 78.27 feet to a point of beginning; thence N 88° 08' 15" W., 579.30 feet to the ordinary high water line of the Missouri River as established by the toe of a river control paving structure; thence along said ordinary high water line S 13° 27' 10" E., 405.25 feet to U.S. Corps of Engineers Control Structure Station 15+00; thence continuing along said ordinary high water line, S 10° 53' 45" E., 60.43 feet to the Northerly line of land owned by the Peavey Elevator Company; thence along said line S 88° 08' 15" E., 868.08 feet; thence N 00° 41' 45" E., 450.00 feet; thence N 88° 08' 15" W., 400.00 feet to the point of beginning, said tract containing 10.097 acres more or less. The East line of said Government Lot Three (3) is assumed to bear North-South.

Except a parcel of land situated in the Southeast Quarter (SE $\frac{1}{4}$ ) of Section 4, Township 74 North, Range 44 West, in the City of Council Bluffs, Pottawattamie County, Iowa, bounded and described as follows: Commencing at a point in the East and West center line of said Section 4, that is 400.0 feet distance Easterly from the center of said Section 4, measured along said East and West Center line; thence Southerly along a straight line forming an angle of 88° 50' from East to South with said East and West center line a distance of 246.71 feet; thence continuing Southerly a distance of 123.97 feet to the true point of

beginning of the parcel of land hereby described; Thence continuing Southerly along the last described line a distance of 21.62 feet to a point along a line curving to the right, having a radius of 373.07 feet a distance of 151.71 feet to a property corner; Thence Westerly along a line which is parallel with the East and West center line of said Section 4, and which lines 528.16 feet distance at a right angle from the East and West center line of said Section 4, a distance of 7.92 feet; Thence Northeasterly along a line curving to the left having a radius of 373.07 feet, a distance of 177.08 feet, more or less, to the true point of beginning; The above described parcel of land contains an area of 575.06 square feet (0.013 Acres) more or less, with the right of ingress and egress.

OWNER: Farmland Industries

EXHIBIT "A"  
Page 7 of 15

## COMPARED

### PARCEL 8:

A part of Government Lot 2 and a part of Government Lot 3 of Section 4, T 74 N, R 44 W of the 5th Principal Meridian, Pottawattamie County, Iowa, in the City of Council Bluffs, which is more particularly described as follows:

Commencing at the center of said Section 4, thence N 88° 08' 15" W, 597.51 feet to the point of beginning; thence N 13° 15' 15" W, 14.59 feet; thence N 16° 42' 15" W, 500.00 feet; thence N 20° 17' 15" W, 51.41 feet; thence N 19° 50' 45" W, 194.30 feet; thence N 51° 05' 20" E, 787.31 feet; thence S 38° 58' 20" E, 170.74 feet; thence Southeasterly 120.39 feet along a 160.00 foot radius curve to the right; thence Southeasterly 171.47 feet along a 240.00 foot radius curve to the left; thence S 36° 47' 45" E, 373.54 feet; thence S 36° 47' 45" E, 126.46 feet; thence southwesterly 143.28 feet along a 160 foot radius curve to the right; thence southeasterly 214.92 feet along a 240 foot radius curve to the left; thence S 36° 47' 45" E, 97.52 feet; thence southeasterly 49.52 feet along a 246.48 foot radius curve to the right; thence S 53° 12' 15" W, 96.07 feet; thence N 88° 08' 15" W, 924.85 feet; thence N 13° 15' 15" W, 81.06 feet to the point of beginning.

OWNER: Eugene R. Severs

EXHIBIT "A"  
Page 8 of 17

84 11257

## COMPARED

**PARCEL 9:**

A part of the NE1/4 NW1/4 of Section 9 T 74 N. R 44 W of the 5th Principal Meridian, Pottawattamie County, Iowa, in the city of Council Bluffs which is more particularly described as follows:

Beginning at the NE1/4 corner of said Section 9, thence N 89° 00' E, 341.77 feet; thence along the westerly right-of-way of River Road S 42° 39' 45" W, 123.47 feet; and Southwesterly 60.50 feet along a 431.97 foot radius curve to the left; thence along the northerly right-of-way line of Interstate Highway I-80 S 85° 07' 15" W, 170.86 feet and S 02° 59' 45" E, 175.00 feet; thence N 52° 55' 05" W, 530.23 feet; thence N 89° 44' 10" E, 357.68 feet to the point of beginning. Said tract contains 95,850 square feet square feet (2.200 acres).

NOTE: The East line of Government Lot 2, Section 4, T 74 N, R 44 is assumed to bear due North and South.

OWNER: Council Bluffs Industrial Foundation

EXHIBIT "A"  
Page 9 of 17

## COMPARED

### PARCEL 10:

A part of the NW $\frac{1}{4}$  NE $\frac{1}{4}$ , Section 9, T 74N, R 44W of the 5th Principal Meridian, Pottawattamie County, Iowa, in the city of Council Bluffs which is more particularly described as follows:

Commencing at the North  $\frac{1}{4}$  corner of said Section 9, thence N 89° 45' 00" E, 459.36 feet to the point of beginning; thence N 89° 45' 00" E, 859.26 feet; thence S 00° 55' 25" W, 88.77 feet; thence along the Northerly right-of-way line of Interstate HWY 1-80 S 64° 48' 30" W, 285.41 feet; S 89° 17' 35" W, 401.12 feet; N 74° 01' 10" W, 321.29 feet and S 85° 00' 15" W, 12.25 feet, thence along the Easterly right-of-way of River Road N 44° 39' 45" E, 174.43 feet to the point of beginning. Said tract contains 168,680 square feet (3.872 acres).

NOTE: The East line of Government Lot 2, Section 4, T 74 N, R 44W is assumed to bear due North and South.

OWNER: Council Bluffs Industrial Foundation

EXHIBIT "A"  
Page 10 of 17

84 11259



## COMPARED

### PARCEL 11:

✓ A part of Government Lots 3 and 4 in Section 4 and a part of the NE $\frac{1}{4}$ , NE $\frac{1}{4}$  of Section 9 all in T 74N, R 44W of the 5th Principal Meridian, Pottawattamie County, Iowa, in the City of Council Bluffs which is more particularly described as follows:

Beginning at the NE corner of the NW $\frac{1}{4}$ , NE $\frac{1}{4}$  of said Section 9; thence S 89° 45' 00"W, 859.26 feet; thence along the Easterly right of way of River Road N 44° 39' 45" E, 195.63 feet; North-easterly 577.34 feet along a 612.96 foot radius curve to the left; N 09° 18' 15"W, 1624.40 feet; Northerly 59.57 feet along a 341.28 foot radius curve to the right; N 00° 41' 45"E, 284.46 feet and Northwesterly 93.7 feet on a 320.79 foot radius curve to the left; thence S 88° 08' 15" E, 419.79 feet; thence along the Southwesterly right of way of the Council Bluffs Levee S 39° 23' 45"E, 1061.03 feet and S 31° 01' 00"E, 839.58 feet; thence along the Northwesterly right of way of Highways I-29 and I-80 Southwesterly 1152.39 feet on a 1021.0 foot radius curve to the right and S 64° 48' 30"W, 366.31 feet; thence N 00° 55' 25" E, 86.77 feet to the point of beginning. Said tract contains 69.10 acres and is subject to a 20 foot sanitary out-fall easement.

OWNER: Council Bluffs Industrial Foundation

EXHIBIT "A"  
Page 11 of 17

84 11260

## COMPARED

### PARCEL 12:

A part of Government Lot 2 in Section 4, T 74N, R 44W of the 5th Principal Meridian, Pottawattamie County, Iowa, in the City of Council Bluffs, which is more particularly described as follows:

Commencing at the center of said Section 4 thence S 88° 08' 15"E, 552.73 feet; thence N 01° 51' 15"E, 30.00 feet to the point of beginning; thence N 38° 12' 15"E, 153.59 feet; thence Northeasterly 100.86 feet on a 449.28 foot radius curve to the right; thence S 38° 58' 22" E, 261.15 feet along the Southwesterly right of way of the Council Bluffs Levee; thence N 88° 08' 15" W, 330.12 feet along the Northerly right of way of 23rd Avenue to the point of beginning. Said tract contains 0.78 acres.

NOTE: The East line of the NE¼ of Section 4 is assumed to bear due North and South.

OWNER: Council Bluffs Industrial Foundation

EXHIBIT "A"  
Page 12 of 17

84 11261

# COMPARED

ACTUAL LEVEE LOCATION  
INRIP LEVEE DISTRICT  
PERMANENT EASEMENT DESCRIPTION

✓ Parts of Government Lots 2, 3, and 4 in the NE 1/4 and the NW 1/4 of Section 9, and the SW 1/4, SE 1/4, NE 1/4 and NW 1/4 of Section 4, all in Township 74 North, Range 44 West of the 5th Principal Meridian, Pottawattamie County, Iowa, in the City of Council Bluffs which is more particularly described as follows:

Cargill Incorporated:

Commencing at the South 1/4 corner of said Section 4, thence N88°42'37"W, 260.3 feet; N06°40'19"E, 46.8 feet; N03°48'34"E, 297.94 feet to the point of beginning. Thence along the following courses; N03°48'34"E, 202.7 feet; N08°23'15"W, 49.1 feet; N27°40'30"W, 139.1 feet; N02°23'19"W, 694.7 feet; N18°11'52"E, 109.2 feet; N04°58'08"W, 400.7 feet; N13°42'41"W, 343.8 feet; S86°35'01"E, 86.3 feet; S10°00'30"E, 229.9 feet; S08°15'34"W, 102.0 feet; S04°58'11"E, 398.9 feet; S19°43'51"E, 207.1 feet; S04°38'49"E, 665.7 feet; S16°02'18"E, 134.2 feet; S07°14'41"W, 70.1 feet; N89°13'02"W, 18.7 feet; S01°49'04"E, 120.0 feet; N89°17'07"W, 113.9 feet to the point of beginning. An area of 4.20 Acres.

EXHIBIT "A"  
Page 13 of 17

84 11262

## COMPARED

### ACTUAL LEVEE LOCATION

### INRIP LEVEE DISTRICT PERMANENT EASEMENT DESCRIPTION

Parts of Government Lots 2, 3, and 4 in the NE 1/4 and the NW 1/4 of Section 9, and the SW 1/4, SE 1/4, NE 1/4 and NW 1/4 of Section 4, all in Township 74 North, Range 44 West of the 5th Principal Meridian, Pottawattamie County, Iowa, in the City of Council Bluffs which is more particularly described as follows:

Warren Oil Company and Robert N. Schlott, et al.:

Commencing at the South 1/4 corner of said Section 4, thence N88°42'37"W, 260.3 feet to the point of beginning. Thence along the following courses; N06°40'19"E, 46.8 feet; N03°48'34"E, 198.6 feet; S88°42'36"E, 107.5 feet; S07°14'41"W, 208.5 feet; S46°20'18"E, 55.9 feet; N88°41'54"W, 140.3 feet to the point of beginning. An area of 0.58 Acres.

Commencing at the South 1/4 corner of said Section 4, thence, N88°42'37"W, 260.3 feet; thence N06°40'19"E, 46.8 feet; and N03°48'34"E, 198.6 feet to the point of beginning. Thence along the following courses; N03°48'34"E, 99.3 feet; S88°14'10"E, 113.4 feet; S07°14'41"W, 98.8 feet; N88°42'36"W, 107.5 feet to the point of beginning. An area of 0.25 Acres.

Commencing at the South 1/4 corner of said Section 4, thence N88°42'37"W, 260.3 feet; thence N06°40'19"E, 46.8 feet; thence N03°48'34"E, 198.6 feet; N03°48'34"E, 99.3 feet; thence S88°14'10"E, 113.4 feet to the point of beginning. Thence along the following courses; N15°40'50"E, 2.1 feet; N91°49'04"W, 120.0 feet; S89°13'02"E, 18.7 feet; and S07°14'41"W, 122.7 feet to the point of beginning. An area of 0.03 acres.

EXHIBIT "A"  
Page 14 of 17

84 11263

# COMPARED

## ACTUAL LEVEE LOCATION

## INRIP LEVEE DISTRICT

## PERMANENT EASEMENT DESCRIPTION

Parts of Government Lots 2, 3, and 4 in the NE 1/4 and the NW 1/4 of Section 9, and the SW 1/4, SE 1/4, NE 1/4 and NW 1/4 of Section 4, all in Township 74 North, Range 44 West of the 5th Principal Meridian, Pottawattamie County, Iowa, in the City of Council Bluffs which is more particularly described as follows:

### Farmland Industries:

Commencing at the center of said Section 4, thence S01°02'46"W, 528.0 feet; and N86°38'52"W, 445.8 feet to the point of beginning. Thence along the following courses; N13°42'41"W, 470.7 feet; S86°47'42"E, 88.0 feet; S14°10'38"E, 395.1 feet; S10°00'30"E, 75.6 feet; N86°35'01"W, 86.3 feet to the point of beginning. An area of 0.93 Acres.

# COMPARED

## ACTUAL LEVEE LOCATION

### INRIP LEVEE DISTRICT PERMANENT EASEMENT DESCRIPTION

Parts of Government Lots 2, 3, and 4 in the NE 1/4 and the NW 1/4 of Section 9, and the SW 1/4, SE 1/4, NE 1/4 and NW 1/4 of Section 4, all in Township 74 North, Range 44 West of the 5th Principal Meridian, Pottawattamie County, Iowa, in the City of Council Bluffs which is more particularly described as follows:

McMillan Oil Company, Inc.:

Commencing at the center of said Section 4, thence S02°14'59"W, 78.3 feet; N86°34'40"W, 564.2 feet to the point of beginning. Thence along the following courses; N15°56'49"W, 674.8 feet; N13°46'05"W, 128.3 feet; N51°23'15"E, 864.6 feet; S37°21'26"E, 95.1 feet; S47°17'54"W, 820.4 feet; S14°10'38"E, 707.6 feet; N86°47'42"W, 88.0 feet to the point of beginning. An area of 4.07 Acres.

EXHIBIT "A"  
Page 16 of 17

# COMPARED

## ACTUAL LEVEE LOCATION

### INRIP LEVEE DISTRICT PERMANENT EASEMENT DESCRIPTION

Parts of Government Lots 2, 3, and 4 in the NE 1/4 and the NW 1/4 of Section 9, and the SW 1/4, SE 1/4, NE 1/4 and NW 1/4 of Section 4, all in Township 74 North, Range 44 West of the 5th Principal Meridian, Pottawattamie County, Iowa, in the City of Council Bluffs which is more particularly described as follows:

#### **Council Bluffs Industrial Foundation:**

Commencing at the South 1/4 corner of said Section 4, thence N88°42'37"W, 260.3 feet to the point of beginning. Thence along the following courses; S88°41'54"E, 140.3 feet; S46°20'18"E, 240.6 feet; S03°26'31"E, 154.3 feet; N57°41'18"W, 398.1 feet; and N06°40'19"E, 111.2 feet to the point of beginning. An area of 1.26 Acres.

## COMPARED

<u>OWNER</u>	<u>PARCEL NO.</u>	<u>PERCENTAGE</u>
Cargill, Inc.	Parcel 1	27.58%
Cargill, Inc.	Parcel 2	9.33%
Warren Oil Company	Parcel 3	0.71%
Robert N. Schlott	Parcel 4	3.67%
Thelma J. Schlott	Parcel 5	0.88%
Thelma J. Schlott	Parcel 6	1.43%
<del>Farmland Industries</del>	<del>Parcel 7</del>	<del>6.32%</del>
Eugene R. Severs	Parcel 8	27.18%
Council Bluffs Industrial Foundation	Parcel 9	0.06%
Council Bluffs Industrial Foundation	Parcel 10	0.20%
Council Bluffs Industrial Foundation	Parcel 11	22.39%
Council Bluffs Industrial Foundation	Parcel 12	0.25%

EXHIBIT "B"

84 11267



HTB/bp09.0983

# COMPARED

March 4, 1982

## Iowa-Nebraska River Industrial Park Flood Protection Levee SPECIAL IMPROVEMENTS AS PER PARAGRAPH 7 OF LEVEE MAINTENANCE AGREEMENT AND EASEMENT Final Assessment Schedule Computations HDR Project No. 1766-03-02

Total Due McAninch Corporation:		
Contract Dated Feb. 24, 1981		
CO #1	Deduct-Return 48" RCP	\$495,413.73
CO #2	Add-Gatewell Lift Modification	- 7,165.55
CO #3	Add-Crushed Rock	+ 4,212.82
		+ 562.50
TOTAL CONSTRUCTION COST		\$493,023.50

### Non-Allocatables:

<u>Cargill:</u>	Bid Item #22, Floodgate	\$9,806.00
	Bid Item #23, Bin Wall	\$27,372.73
	Bid Item #24, Concrete Wall	\$10,270.00
	Bid Item #25, Cable Tie-Down	\$1,585.00
	Bid Item #26, Cable Tie-Down	\$1,585.00
	Bid Item #27, Cable Tie-Down	\$1,585.00
	Bid Item #48, Remove Iron Pipe	\$ 500.00
	Change Order #3, Crushed Rock	\$ 562.50
	Credit for Earthwork	-4,803.00

### TOTAL CARGILL

\$48,463.23

<u>Farmland:</u>	Bid Item #29, Conveyor Modification	\$2,230.00
	Bid Item #30, Raise Winch Pad	\$1,500.00

### TOTAL FARMLAND

\$3,730.00

### McMillan/Eugene R. Severs:

	Bid Item #31, Timber Pile Cribwall	\$5,088.00
--	------------------------------------	------------

\$57,218.23

### TOTAL NON-ALLOCATABLE COST

### ALLOCATABLE CONSTRUCTION COST

Equivalent Earthwork on Cargill Property	\$430,939.27
--	--------------

TOTAL ALLOCATABLE CONSTRUCTION COST	4,803.00
-------------------------------------	----------

Engineering Fees	\$435,742.27
------------------	--------------

Legal Fees	\$ 69,489.25
------------	--------------

Interest on Warrants	
----------------------	--

### TOTAL ALLOCATABLE COST

\$

EXHIBIT "C"

84 11268

5/21/85

IOWA POWER AND LIGHT COMPANY  
UNDERGROUND ELECTRIC LINE  
EASEMENT

**COMPARED**

Located in:

13027

C.W.O. 22-32-5932  
Parcel No.  
Deed No.

State of Iowa Iowa  
County of Pottawattamie  
Section 4  
Township 74 North  
Range 44 West of 6th P.M.

KNOW ALL MEN BY THESE PRESENTS:

For and in consideration of the sum of One and no/100 Dollars (\$1.00), and other valuable consideration, is here paid by the IOWA POWER AND LIGHT COMPANY, an Iowa corporation, receipt of which is hereby acknowledged, the undersigned

Robert N. Schlott

do hereby grant to Iowa Power and Light Company, its successors or assigns, (hereinafter) the right to lay, maintain, operate, repair and remove underground conduit, wires and other necessary equipment incident thereto (including associated surface mounted equipment) through and across certain property described below, together with ingress and egress to and from the same, and all the rights and privileges incident and necessary to the enjoyment of this grant.

In consideration of such grant, Iowa Power and Light Company agrees that it will repair or pay for any damage which may be caused to crops, fences or other property of the undersigned by the construction, maintenance, operation or removal of said line, except such property placed subsequent to the granting of this easement that interferes with the operation and maintenance of the line and associated equipment.

Additionally, Iowa Power and Light Company shall have the right to remove from the strip of land specifically described below, any obstructions, including trees, plants, undergrowth, buildings and structures that interfere with the proper operation and maintenance of said line and equipment.

Grantor agrees that they will not construct or place any buildings, structures, trees, plants or other objects on the property described below which would interfere with the operation and maintenance of the line.

EASEMENT DESCRIPTION:

Easement to consist of a ten (10) Ft. tract of land, centerline of said tract beginning at a point 542 Ft. West along the South line, then 330 Ft. North of the Southeast corner of the SW<sup>1</sup>/<sub>4</sub>, SE<sup>1</sup>/<sub>4</sub>, of Section 4, Township 74, Range 44, Pottawattamie County, Iowa; thence extending 20 Ft. East to its ending point.

STATE OF IOWA, Pottawattamie County  
Filed for record this 21st day of May, 1985, at Council Bluffs, Iowa.  
Witness my hand and seal of office this 21st day of May, 1985.  
John Scintigro  
Notary Public  
Mildred Brash  
Deputy

This easement shall be binding upon the heirs, successors, and assigns of both parties and shall continue until cancelled by mutual consent, or the removal and abandonment of said line. Grantors shall have the right of full enjoyment and use of the above described property except as such that will be inconsistent with this easement.

Dated this 21 day of May, 19 85 at Council Bluffs, Iowa

Robert N. Schlott  
Robert N. Schlott

STATE OF IOWA DOUGLASS  
COUNTY OF DOUGLASS

ACKNOWLEDGMENT

On this 21st day of May, A.D., 19 85, before me, a Notary Public, personally appeared Robert N. Schlott

to me known to be the person(s) who are named in and who executed the foregoing instrument, and acknowledged that he executed the same as a voluntary act and deed.

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**1980 PARCEL PLOTS – INCLUDED FOR REFERENCE ONLY**

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INTERSECTION OF PROPERTY LINES WITH CENTER LINE LEVEE			
	North	East	Station
A	458,219.694	1,337,918.773	207 + 02.47
B	458,448.368	1,337,652.926	208 + 27.26
C	458,488.349	1,337,654.757	208 + 77.57
D	458,712.765	1,337,682.796	211 + 03.73
E	458,812.373	1,337,692.467	212 + 04.02
F	459,915.378	1,337,601.514	223 + 28.19
G	460,715.380	1,337,509.995	231 + 34.18
H	461,172.596	1,337,599.141	236 + 08.96

IOWA MODIFIED STATE PLANE COORDINATE TABLE			
STATION	NORTH	EAST	P.I. STATION
0	458,096.58	1,338,084.57	202 + 98.75
1	Not Used	---	---
2	458,421.94	1,337,646.46	208 + 21.47
3	458,095.05	1,337,720.99	214 + 52.13
4	458,169.04	1,337,644.05	215 + 00.81
5	458,670.30	1,337,633.56	220 + 01.05
6	460,180.67	1,338,568.97	228 + 55.46
7	460,617.04	1,337,546.71	230 + 35.39
8	460,759.41	1,337,492.81	231 + 03.43
9	460,946.31	1,337,460.21	232 + 72.70
10	460,999.29	1,337,449.46	234 + 27.66
11	461,063.01	1,337,438.61	234 + 02.85
12	461,825.35	1,337,424.00	242 + 02.83
13	461,946.33	1,339,581.66	244 + 00.00
14	462,506.37	1,337,508.03	253 + 00.00
St. Corner Sect. 4	458,463.550	1,337,686.940	N.A.
Center Sect.	461,220.057	1,337,917.279	N.A.

**Results of Bearings and Coordinates**  
 Bearings are Iowa State Plane Grid Bearings  
 Coordinates are Iowa State Plane Grid (South Zone), modified to ground elevation  
 Iowa State Plane Coordinate Data  
 South Quarter Corner of Section 4, T4N, R44W  
 $x = 1,337,725.830$  Lat. =  $41^{\circ} 13' 59".1637$   
 $y = 458,418.622$  Long. =  $95^{\circ} 54' 29".1074$   
 $k = 0.99994853$  0 =  $1^{\circ} 35' 10".7899$   
 Combined Factor = 0.999902  
 Center of Section 4, T4N, R44W  
 $x = 1,338,786.163$  Lat. =  $41^{\circ} 14' 25".4011$   
 $y = 461,174.858$  Long. =  $95^{\circ} 54' 29".4475$   
 $k = 0.9994861$  0 =  $1^{\circ} 35' 10".5738$   
 Combined Factor = 0.999902  
 Grid Azimuth = 0 = Geodetic Azimuth

NOTE: Permanent Easement is 15 feet each side of toe of 3:1 Levee Slope. (not including 50:1 seepage berm.)



0 100 200 300 400 feet

DOUGLAS COUNTY  
 POTTAWATTAMIE COUNTY

NEBRASKA  
 IOWA

COUNCIL BLUFFS LEVEE  
 P.I. 61.10 to E. UPRR

WEST R. RIVER ROAD  
 828.65

END BASE BID LEVEE CONSTRUCTION

CENTER SECTION 4  
 T4N R44W

MACMILLAN OIL CO.  
 13.8 AC

FARMLAND  
 10.1 AC

CARGILL CORP.  
 18.6 AC

CARGILL CORP.  
 19.6 AC

TERMINAL PACK

CBIF  
 2.2 AC

CBIF  
 3.9 AC

BENCH MARKS

981.87 Bell in center line of concrete pier base, west pier of 1-80 Missouri River Bridge.  
 986.56 Top Nut of support, 12' east of southeast corner of Cargill Maintenance building (Survey Sta. 8910-61).  
 989.28 Top of Repair in center line of Govt. Levee at survey Station 53+45.5  
 989.43 Top of Concrete at east most corner of Base Structure at P.P.E. tower, on west side of Road, Levee.

TABLE OF OFFSETS AND STATIONS ON SURVEY BASELINE TO P.I. ON LEVEE		
STATION ON SURVEY BASELINE	OFFSETS FROM BASELINE TO P.I.	
0+00.00	0.0	
0+49.28	28.75' left	
1+43.23	44.38' right	
1+49.00	22.00' left	
2+00.00	18.00' right	
2+14.12	0.0	
3+00.00	18.00' right	
3+49.00	11.00' left	
4+00.00	0.0	
4+49.00	0.0	
5+00.00	0.0	
5+49.00	0.0	
6+00.00	0.0	
6+49.00	0.0	
7+00.00	0.0	
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98+49.00	0.0	
99+00.00	0.0	
99+49.00	0.0	
100+00.00	0.0	
100+49.00	0.0	

PROPERTY CORNER COORDINATES		
STATION	North	East
100	458,110.54	1,337,923.53
102	458,113.43	1,337,672.54
104	458,471.80	1,337,308.55
106	458,491.58	1,337,510.78
108	458,716.28	1,337,526.85
110	458,816.14	1,337,534.00
112	458,898.16	1,337,539.86
114	459,288.50	1,337,556.72
116	459,788.46	1,337,561.56
118	459,919.26	1,337,530.91
120	460,720.20	1,337,429.30
122	460,779.83	1,337,419.49
124	461,176.37	1,337,325.94
126	461,235.66	1,337,526.83
128	461,269.99	1,337,317.87
130	461,732.57	1,337,187.20
132	461,901.26	1,337,170.49
134	461,945.98	1,337,109.78

SITE LAYOUT PLAN

JOB NO.	1776	DATE	BY	DESCRIPTION
03				
02				
1				
DESIGN	S.H.	DATE	APPR.	L.E.B.
HENNINGSON, DURHAM & RICHARDSON, INC.				
ENGINEERING • ARCHITECTURE • PLANNING • SYSTEMS • ECONOMICS				
SHEET				3 OF

IOWA-NEBRASKA RIVER  
 INDUSTRIAL PARK  
 FLOOD PROTECTION LEVEE

DATE SEPT. 1980

**APPENDIX B – RECOMMENDED INSPECTION, OPERATIONS AND  
MAINTENANCE PRACTICES**

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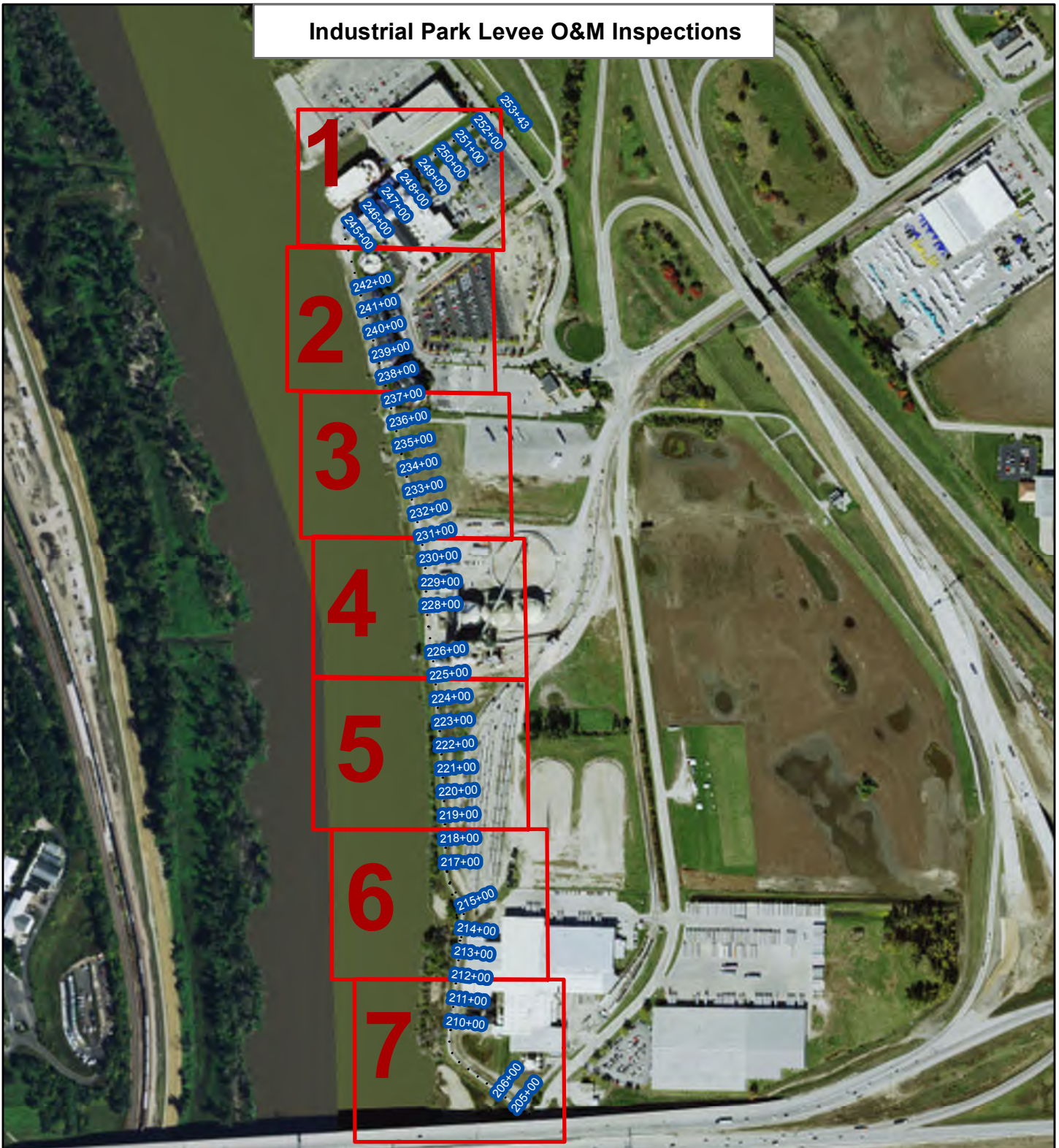


## FIGURES

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# Industrial Park Levee O&M Inspections



Pages

224+00 IPL Station



0 300 600 Feet

**CDM  
Smith**



# Industrial Park Levee O&M Inspections Page 1



- Outfalls
- ☒ Drainage Structures
- ⚡ Underground Encroachment\*
- ⚡ Above ground Structure (Encroachment\*)
- Sheet Pile Wall

- ⚡ Building Encroachment\*
- ☒ Pressure Relief Wells and Monitoring Wells
- ☒ Sump
- ☒ Riprap

- 224+00 IPL Station
- Outfall ID Outfall ID



0 75 150 Feet

\* Refer to Table 9 for encroachment description

**Inspection Notes:**



# Industrial Park Levee O&M Inspections Page 2



- Outfalls
- ☒ Drainage Structures
- ⚡ Underground Encroachment\*
- ⚡ Above ground Structure (Encroachment\*)
- 🔲 Building Encroachment\*
- 🔲 Riprap
- 224+00 IPL Station
- Outfall ID Outfall ID

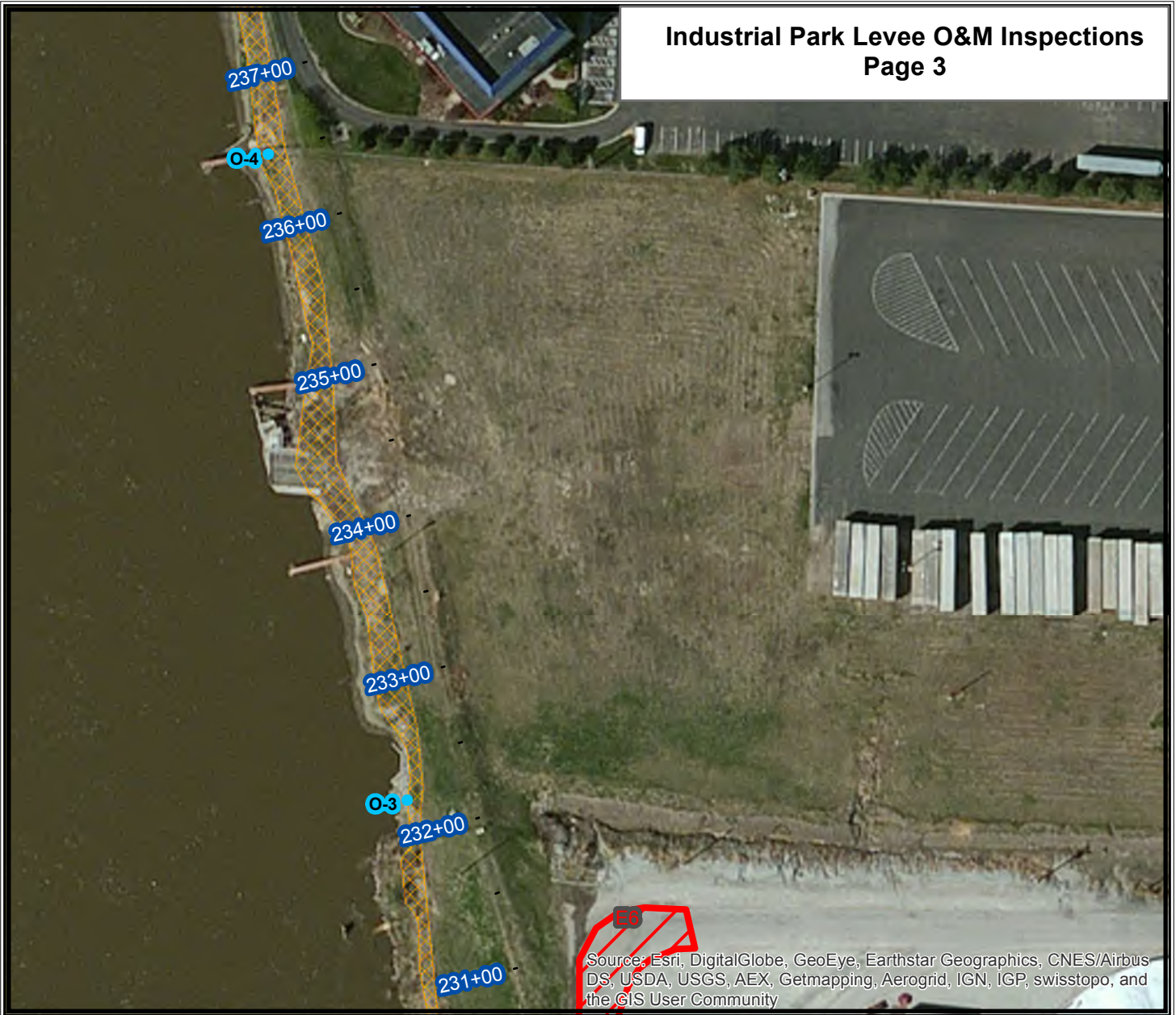


0 50 100 Feet

\* Refer to Table 9 for encroachment description

Inspection Notes:

# Industrial Park Levee O&M Inspections Page 3



- Outfalls
- Road Encroachment\*
- Riprap
- 224+00 IPL Station
- Outfall ID Outfall ID

\* Refer to Table 9 for encroachment description

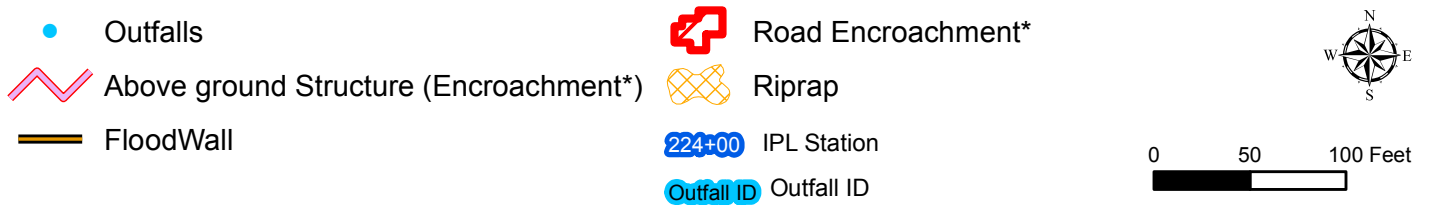


0 50 100 Feet

Inspection Notes:

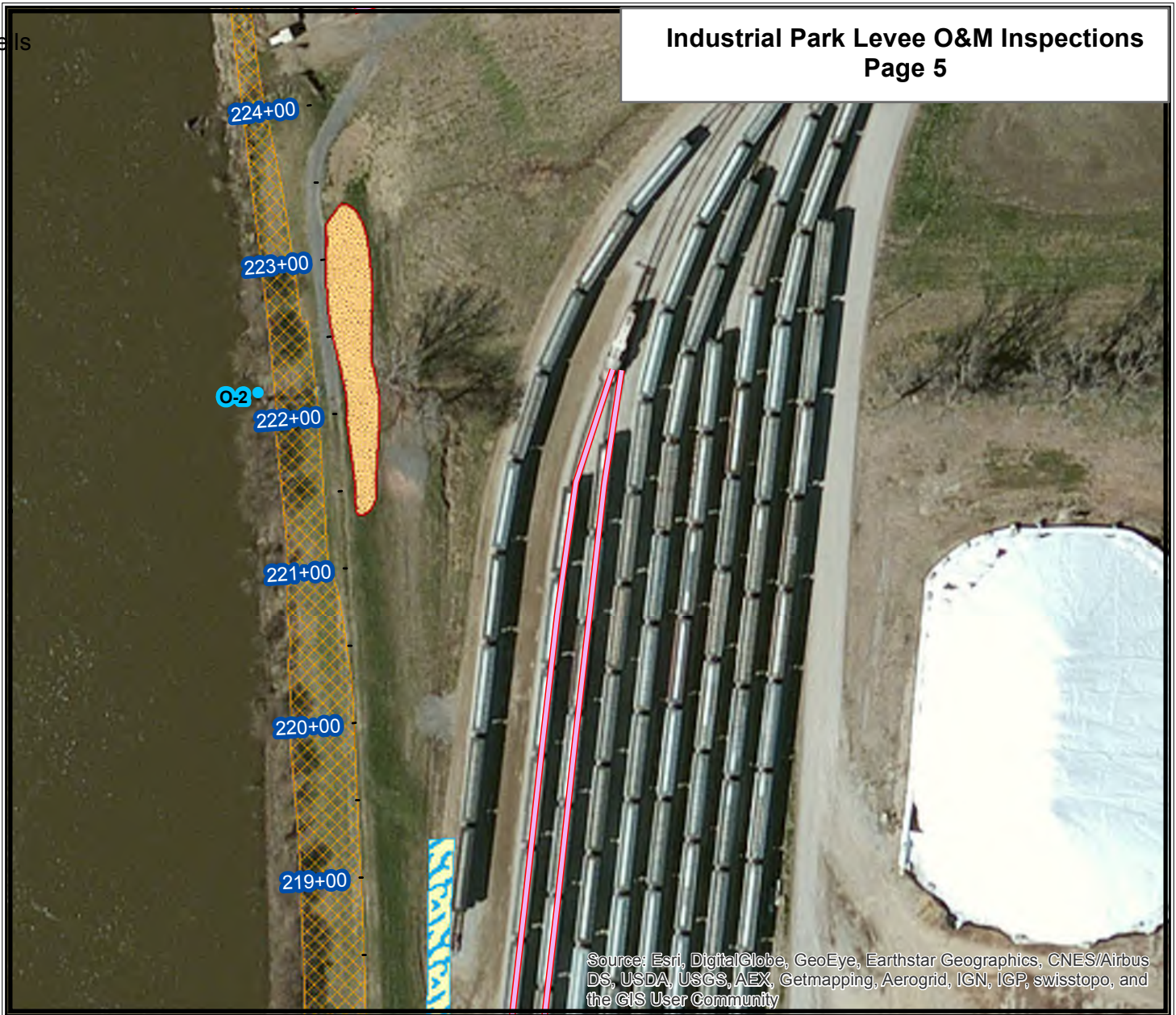


# Industrial Park Levee O&M Inspections Page 4



\* Refer to Table 9 for encroachment description

Inspection Notes:



- Outfalls
- ⊗ Riprap
- ~ Above ground Structure (Encroachment\*)
- 224+00 IPL Station
- O-2 Outfall ID
- ⊗ Inspect for Seepage
- ⊗ Pressure Relief Wells and Monitoring Wells



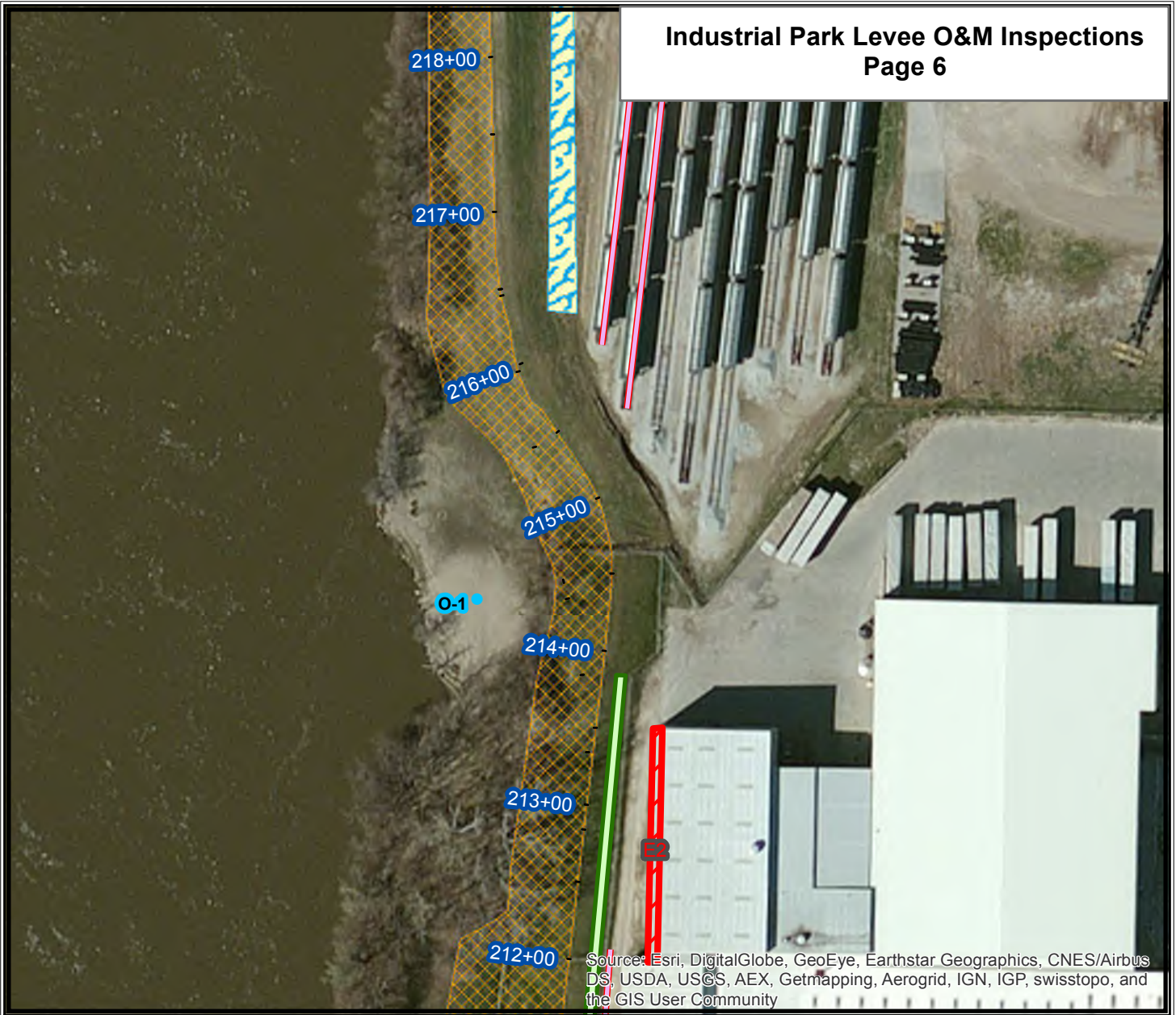
0 50 100 Feet

\* Refer to Table 9 for encroachment description

Inspection Notes:



# Industrial Park Levee O&M Inspections Page 6



- Outfalls
- / Above ground Structure (Encroachment\*)
- Building Encroachment\*
- Inspect for Seepage
- Riprap
- Trench Drain
- 224+00 IPL Station
- Outfall ID Outfall ID








0 50 100 Feet

\* Refer to Table 9 for encroachment description

Inspection Notes:

# Industrial Park Levee O&M Inspections Page 7



-  Above ground Structure (Encroachment\*)
-  Riprap
-  Inspect for Seepage
-  Trench Drain
-  224+00 IPL Station



0 50 100 Feet

\* Refer to Table 9 for encroachment description

Inspection Notes:

## **RECOMMENDED SEED MIXTURES**

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Bullet #7 - The following is the recommended seed mixture.

<u>Botanical Name</u>	<u>Common Name</u>	<u>Pounds PLS/Acre</u>
Bouteloua curtipendula	Side-oats Grama	3.0
Agropyron smithii	Western Wheatgrass	3.0
Panicum virgatum	Switchgrass	2.5
Elymus virginicus	Virginia Wildrye	2.0
Elymus canadensis	Canada Wildrye	2.9
Eragrostis trichodes	Sand Lovegrass	4.0
Schizachyrium scoparium	Little Bluestem	3.0
Festuca arundinacea	Tall Fescue	5.0
Andropogon gerardii	Big Bluestem	3.0
Sorghastrum nutans	Indian grass	3.0
Agrostris alba	Red Top	0.2
Nurse Grass	Oats	<u>50.0*</u>
Total		81.6

Temporary Seed:

Spring, Common Oats (Certified)

Fall, Annual Rye

\*Not PLS

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# **PLASTIFAB GATE MANUAL**

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WARREN AND CARGILL GATES

(AMERISTAR GATES TO BE ADDED)

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## PLASTI-FAB HEAVY DUTY TITSEAL GATE: MANUAL FOR INSTALLATION | OPERATION | MAINTENANCE

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☒ Reviewed (A) \_\_\_\_\_  
☐ Reviewed-See Reviewer Comments-Resubmittal not Required (B)  
☐ Revise and Resubmit (C)  
☐ Not Required for Review (D)  
☐ Requires Review and Approval by General Contractor (E)  
This stamp is used in conjunction with the HGM CONTRACTOR  
SUBMITTAL/TRANSMITTAL FORM and all the information and  
responsibilities contained within that form. HGM Associates Inc.  
Reviewed by: ZMW Date: 12-3-14

## FOREWORD

This manual covers the full range of gates manufactured by Plasti-Fab, Inc. Therefore, some information may not apply to your particular style of gate. Please keep this in mind as you read this manual.

This manual provides information for engineers, contractors and plant operators involved with installation, operation and maintenance of equipment supplied by Plasti-Fab, Inc. Every care is taken in our factory to insure equipment of top quality. However, we cannot be responsible for damage caused by negligence during or after shipping. Therefore, described herein are Plasti-Fab, Inc.'s recommended methods of handling, storage, installation, adjustment and initial operation for standard situations. This information should be used in conjunction with the approved installation drawings provided by Plasti-Fab, Inc. If proper care and accuracy are exercised in the field during installation, the gates will operate as designed at maximum efficiency.

## RECEIVING

*Check and Count* all parts when you receive shipment. All individually shipped parts or assemblages are listed on the packing list. Should a shortage exist, notify Plasti-Fab immediately. We cannot be responsible for any shortages reported more than 30 days after receipt of shipment. Special care should be taken in accounting for and safely storing all bolts, nuts and small items that are often misplaced at job sites.

Unless your contract with Plasti-Fab, Inc. states otherwise, all equipment is shipped F.O.B. factory. If any equipment has been damaged in transit, the purchaser will be responsible for filing a freight claim with the transportation company. For assistance in filing any claim and/or replacing equipment, please contact Plasti-Fab, Inc. directly.

## HANDLING AND STORAGE

All Plasti-Fab gates and appurtenances are precision machinery and should be handled accordingly. While all parts are of rugged design, it is still possible to damage surfaces, stems, etc., through improper storage and handling. To avoid all problems of this nature, we recommend the following:

1. Handle the Heavy Duty Tite Seal Gates as you would handle any precision machinery. Support full length of stems at all times, being sure not to damage threads.
2. Store equipment on an even, clean, dry surface to prevent distortion.
3. Cover all equipment to protect surfaces.
4. **DO NOT** stack equipment without protection.
5. Handle lifts as you would any precision machinery.

See Electric Motor Operator instructions for storage of electric motor operators.

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## SECTION I: INSTALLATION

### GATE AND GUIDE INSTALLATION

Some gates can be removed from guides to make guide mounting easier. Do so when practically possible. If they must be dismantled, see "Disassembly of Gates". See product bulletins for description of various types of guide frames offered by Plasti-Fab, Inc.

**NOTE:** We recommend leaving self contained gates in the guides during installation.

### SURFACE MOUNTED GUIDES

Placement of anchor bolts is critical for an easy and proper guide installation. Be sure placement is identical to print. Check hole spacing on guide before installing anchor bolts. Install anchor bolts before mounting the guide on the wall. If bolts do not align with holes, it may require adjustment of bolts or re-drilling holes. Consult factory before boring out an existing hole. **DO NOT** hammer the guide onto the bolts. This may damage the guide frame. Be sure to maintain integrity of dimensions.

Once guide is mounted on the anchor bolts, adjust to a flat plane and grout or seal between the guide and the wall. Be sure all bolts have washers before tightening nuts.

Before operating, be sure all guides are clean and free of debris.

### EMBEDDED GUIDES

Embedded frames may be installed in one of two ways. If you have the guide on-site before pouring, you can mount them in the concrete forms and pour around them. Be sure they are level, well fastened and all inside grooved surfaces are protected from concrete or debris.

**NOTE:** Proper guide dimensions must be maintained at all times, and care must be taken to protect grooved sliding surfaces from debris.

The second method may be used if the guide is not on the job site at the time of the pour. At the location where the guide is to be mounted, build a block out into the forms that is larger than the guide frame. Allow at least 1" of space around sides and back of the guide frame for grouting purposes. Secure the frame firmly and protect against debris.

### STEM INSTALLATION, STEM GUIDE ADJUSTMENTS AND LIMIT NUT POSITIONING

Most of Plasti-Fab gates are self-contained units. The gate is mounted in the guide with the stainless steel stem attached and threaded through the lift on the head frame. Limit nuts are factory set on all self-contained gates. For those units not having a self-contained frame, read the following sections on Stem Installation, Stem Guide Adjustment and Limit Nut Positioning.

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## STEM INSTALLATION

1. Take care not to bend stem or damage threads. This is especially true on electric operated lifts. Extra care should be taken with stems for these operators.

**NOTE:** When a limit nut is used to stop the upward travel of a gate, the limit nut must be installed prior to the lift. See "Installation of Limit Nuts", Pg. 4.

2. After the gate, guide frame assembly and stem guides have been mounted, feed the stem down (or up, as required) through the head frame, stem guides and stem mounting bracket on the gate. Bolt stem to the mount.
3. At this point, the lift or lift nut may be threaded onto the stem by one of two methods depending on the circumstances and type of lift being used. The first way is to bolt the stem to the gate mounting plate and then thread the lift or lift nut down from the top of the stem to its proper mounting position. The second way is to position the lift over the stem and screw the stem into the lift until the stem is properly positioned to be bolted to the gate mounting plate.
4. Thoroughly clean and grease stem threads with heavy duty grease, such as Mobilox grease #3EP or equal. (See Maintenance section for equivalent greases.)

## STEM GUIDE ADJUSTMENT

After the stem is installed and the lift is bolted into position, check stem guides for proper alignment with the stem. The stem should not ride with direct pressure against the walls of the stem guide. If the stem is forcing against the stem guide, loosen the stem guide mounting bolts and position the guide so the stem is centered in the guide hole.

If enough adjustment cannot be made at the stem guide, move to the next guide or to the lift on the head frame to obtain needed adjustment. Loosen bolts and center as previously outlined. If the stem continues to ride on the guide, consult the local representative or manufacturer.

After stem guides are properly aligned, secure all bolts on guides, lifts and stem mount. Rotate the stem several times and make careful note of any stem wobble or rubbing. If either of these conditions exist, readjust as previously described. If further adjustment does not resolve the problem, consult the local representative or Plasti-Fab, Inc.

**NOTE:** Before operating gate, read operating instruction in Section II of the manual.

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### INSTALLATION OF LIMIT NUTS AND STEM COVERS

1. **IMPORTANT:** In those cases where a limit nut is used to stop upward gate travel and a pedestal lift is also used, the limit nut must be installed on the stem prior to installing lift.
2. After lift is installed, with gate in closed position, screw top limit nut down on stem until it just starts to bottom out on top of the lift nut. Tighten setscrews.  
**NOTE:** If gates have wedges that require adjustment, final setting and tightening of nut will have to be done after gate wedges are adjusted.
3. Screw stem cover into threaded bracket on top of lift. A thread sealant should be used on threads. Cover should be approximately four inches longer than gate height.

### LIMIT NUT ADJUSTMENT

Setting and maintaining correct limit nut placement is vital to the protection and operation of the gate, guide and lift assembly. Limit nuts that are factory set should need no adjustment.

1. To regulate the upward opening ability of the gate, place the limit nut on the stem between the gate and lift. Open gate to desired height, screw the limit nut up the stem until it is against the lift, and secure Allen screws on limit nut against stem.
2. To limit the downward closing ability of the gate, place the limit nut on the stem above the lift. Close the gate to the desired position, screw the limit nut down against the lift and secure Allen screws on limit nut against the stem.
3. For a non-rising stem, make same adjustments as mentioned above, except place the limit nut in reference to the gate rather than the lift.

### ADJUSTING WEDGING BAR

The fiberglass Heavy Duty Tite Seal gates are equipped with a seal adjustment feature. The gate seals were initially adjusted at the factory; however, they may need to be tightened to achieve the specified leakage rate of 0.1 gpm/foot of wetted perimeter for seating heads or non-seating heads.

1. Using a properly sized wrench. Loosen and back off locking nuts on each of the large silicone bronze adjusting bolts.
2. Tighten each of the adjusting bolts uniformly in stages until the desired leakage rate is achieved, and clamping bar is straight through the full length of the gate. This should take no more than 1/4" - 1/2" turn on the bolts. If leakage persists, check seal between the gate and frame. Excessive tightening of adjusting bolts can cause seal damage.
3. Secure the locking nuts back in place.

**NOTE:** Gate is operable with wedging bar tightened into position.

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#### INSTALLATION OF ELECTRIC MOTOR OPERATORS:

1. Install motor operated lifts in same manner as the manual lifts described in "Stem Installation".
2. **IMPORTANT:** Alignment of lift and stem is of critical importance. Double check all components (stem, stem guides, brackets, pedestal, lift, etc.) to insure all are as perfectly aligned as possible.
3. *Using Emergency handwheel, manually open gate a minimum of three inches prior to using any electrical controls. Double check handwheel for proper rotation indication.*
4. Connect electrical power and any remote wiring in accordance with wiring diagrams. During wiring installation, should it become necessary to leave unit, close and tighten limit switch compartment and any open conduit taps so no electrical components are left unprotected.
5. With gate open a minimum of three inches, check electric operator for proper rotation and wiring. By having gate open, the direction of rotation can be checked without damaging the stem, stem cover or hoisting unit.
6. Once the unit has been installed, the electric operator manufacturer's directions should be followed closely in setting the closing and opening limit switches. (See "Installation, Inspection and Adjustment".) The torque switches have been properly set at the factory and should not need adjustment. Follow the manufacturer's instructions if it appears that adjustment is necessary.
7. Lifts are factory lubricated and do not need lubrication at the time of installation.

#### SECTION II: OPERATING INSTRUCTIONS

##### INITIAL OPERATION OF GATES

1. After gate, stem guides, stem, lifting mechanism and other necessary hardware has been installed check the following before operation.
  - a. Check all assembly and mounting hardware for proper tightness.
  - b. Apply tension to stem and check for proper alignment. Remove any shipping stops on gates.
  - c. Check guide grooves for any foreign matter.
  - d. Clean all dirt, paint, concrete splatter or other foreign material from seating surfaces, wedges, flush bottom seals, etc.
2. If not done previously, or if gate stem has not been used for some time after installation, thoroughly clean stem threads and lubricate in accordance with stem installation instruction.  
(Continued on next page...)

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3. Raise gate to full open position. All lifts are factory lubricated so there is no need for additional lubrication.

- a. For manually operated lifts, turn handwheel or handcrank in direction noted on handwheel or lift housing.
- b. Electric operators should be opened manually for the first three (3) inches and the last three (3) inches of gate travel until all limit and torque switches are set and checked. Electrical operation is accomplished by actuating push buttons on operator.

In those cases where operator has both local and remote controls, operator should be operated only with local controls. Maximum caution must be exercised during this phase.

- c. For pneumatic operators, pressure must be applied to bottom side of cylinder piston to raise the gate. This should be done with manually actuated controls, rather than automatic controls. Pressure must be applied very slowly and carefully.

For pneumatic operators, gate may "jump" out of closed position then begin steady rising movement. There is no way to prevent this.

Regardless of operator type, operation should be easy and unlabored. If not, check for binding or other causes by reviewing previously mentioned installation and start-up procedures. Do not apply excessive force to handwheel or handcrank on operators. In most cases, they are designed to operate at 40 lb. maximum pull.

- 4. Seating surfaces of fiberglass slide gates, including gates with UHMW polyethylene strips, require no lubrication. NOTE: **DO NOT** apply any petroleum product to neoprene seals as a lubricant.
- 5. Close gate completely and check for proper closure.

**CAUTION:** Be extremely careful when closing gate. The stem can buckle (bow) under a compressive load if excessive force is applied to the operator.

- a. Check to see that slide fits flat against seating surface.
  - b. Check to be sure frame is not warped.
  - c. Adjust wedging bar on Heavy Duty Titescal Gates to desired leakage. (See Adjusting Wedging Bar).
- 6. Check and reset any limit nuts or position indicators as required. (See Limit Nut Adjustment).
  - 7. Cycle gates with operators to insure proper installation, alignment and operation.

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### INITIAL TEST OPERATION OF ELECTRIC MOTOR OPERATORS

The following test procedure is to be performed in addition to "Initial Operating" requirements previously specified. The purpose of this test is to check for proper installation and alignment of stem and operator. This test should be performed as soon after installation and as long before final inspection acceptance as possible.

If the stem is misaligned, warped or the threads have been damaged, the stem will cut the threads out of the lift nut, eventually causing the gate to fall. If there is a problem, evidence usually begins showing up after three to five gate cycles. On large gates failure can occur as soon as 12 to 15 cycles. For this reason, we recommend that each gate with an electric operator be cycled electrically about fifteen (15) times.

The following test procedure should be performed over a time period of a few hours to a few days. During start-up, remember to avoid running the gate operator continuously. Most electric operators have a 15 or 30 minute duty cycle. Depending on motor, operating times should be limited to fifteen (15) to thirty (30) minutes per hour.

### TEST PROCEDURE

1. Check to make certain stem has been thoroughly cleaned and has clean coating of grease, then cycle gate three (3) times.
2. Check grease for any signs of bronze. These may be chips or small filings. A few pin head size pieces of bronze or some discoloration of stem is normal.
3. Clean stem and re-lubricate with fresh, clean grease.
4. If there were quite a few chips, recheck installation and alignment, then cycle gate three (3) more times. If there are very few chips, no checks are required and gate can be cycled five (5) times.

During these tests, be aware of any strange noises from operator or stem that could indicate trouble. Stop tests and locate trouble.

5. After cycling gates, recheck for evidence of bronze stripping from nut.
  - a. If stem and grease is fairly clean and free of bronze chips or shavings, clean stem, re-lubricate and cycle five (5) more times. Recheck final time and if only minute amounts of bronze show, installation are correct.
  - b. If the appearance of the bronze is not too great, the stems should be cleaned and re-lubricated. Double check entire installation, especially alignment. Repeat checking, cleaning and cycling for a minimum of fifteen (15) cycles. If there still appears to be a problem, call the factory.
  - c. If the amount of bronze is excessive, test should be stopped and factory called. See "Field Service" for on-site inspection by a factory service representative to evaluate problem and determine whether any equipment needs to be replaced. Gate should not be operated further until it can be checked out.

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### Things to look for if problems are encountered

Depending on severity, factory should be consulted.

1. Observe stem from below operator while gate is being cycled.
  - a. If stem seems to move back and forth or side-to-side, stem may be warped or bent.
  - b. Check to see if stem is rubbing or binding on stem guides or other structure. May indicate alignment problems.
2. Check stem threads.
  - a. If thread crests appear to be mushroomed or slightly rolled over on one side of stem while opposite side (180° away) looks all right, check for alignment problem.
  - b. Stem threads appear rough, chipped or galled. Possibility of damaged threads.

### OPERATION WITH PORTABLE ELECTRIC OPERATOR

1. With handcrank, open the gate slightly.
2. Loosen setscrew on handcrank and remove handcrank from lift.
3. Position portable operator support so socket of operator lines up with input shaft. Adjust height as necessary.
4. Slip socket on input shaft until fully engaged (minimum 1 inch) and tighten set screw on socket.
5. Plug operator into 115V, 60HZ power source. Be sure outlet is grounded type.
6. Set forward/reverse switch as required for proper gate operation. Direction to open gate is shown on lift above input shaft.
7. Depress trigger switch on portable operator handle to start unit. Operator will continue to run as long as switch is depressed.
8. When limit nut is reached or if overload occurs, overload release clutch will automatically release so no further torque is applied to input shaft.
9. To reset clutch, either reverse rotation or disengage and remove portable operator from lift and electrically "jog" operator. Clutch will automatically reset after several revolutions.

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### SECTION III: MAINTENANCE

#### MAINTENANCE OF COPOLYMER COMPOSITE GATES AND GUIDES

Other than periodic cleaning to maintain smooth operation of the gates and general sanitation throughout the plant, maintenance of the fiberglass portions of the gates is not required. If desired, the fiberglass material may be cleaned with detergent or water.

Periodic inspection of guides and gates is recommended to insure trouble-free operation. Check for debris that may have caught or collected on the gate and clean accordingly.

#### MAINTENANCE OF OPERATING STEMS

1. Operating stems MUST be cleaned and greased periodically. Some environmental conditions are harsher than others. The use of stem covers will protect stems, but they still need to be cleaned and greased with Mobilux grease #2EP or equal at least once every six months (see Lubrication Chart for equivalent brand names). Lubricate more often if the grease becomes dirty.
2. **WARNING!** Gates with non-rising stems generally require a special maintenance program. If the level of the water or sewage rises above the top of the gate, the threads on the stem may become coated with grit. Under this condition, frequent cycling of the gate can wear the threads in the thrust nut and create a potentially dangerous situation. Therefore, the following maintenance procedure should be followed:
3. The stem should be inspected at least monthly.
  - a. The stem should be kept clean and greased. Regular hose downs are recommended.
  - b. If the gate is cycled on the average of once a week, the thrust nut should be removed every year and inspected for wear. (More frequently after the first signs of wear or if operating conditions are more severe).

#### MAINTENANCE OF GATE OPERATORS

1. The manual crank operators contain ball or roller bearings and should be lubricated at least three (3) times a year. All grease fittings on manual floor stands should be lubricated with a small amount of heavy duty grease such as Zenaplex II, manufactured by Pennwalt Keystone Company, or equal (see Lubrication Chart for equivalent lubricants).
2. **CAUTION:** DO NOT OVERFILL when lubricating pinion shafts on manual 3EP series lifts.
3. For electric motor operators or cylinder lifts, see separate manufacturer's O & M manuals.

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#### MAINTENANCE OF PORTABLE ELECTRIC OPERATOR:

1. When not in use, portable operator should be stored in a dry protected area, out of the weather, with the cord neatly coiled or looped and off the floor.
2. Should operator be used in inclement weather, the operator and chord should be thoroughly cleaned and dried prior to storage.
3. See Manufacturer's Operating and Maintenance Instructions for lubrication.
4. In time, as clutch is run and parts become worn, the torque release setting may decrease making it necessary to reset the clutch. See Manufacturer's Operating and Maintenance Instructions for adjustment instructions.

#### MAINTENANCE OF UHMW AND SEALS

If desired, neoprene J-seals may be lubricated using silicone "grease" such as G. E. Silicone Compound G661 or equal.

**CAUTION:** Do not apply any petroleum product to these seals as a lubricant.

Neoprene seals rarely need replacement. However, if the seals and/or UHMW become improperly positioned or damaged, they may be serviced by one of the following procedures.

#### GATES SERVICED IN GUIDES

Gates that are readily accessible can be worked on while still mounted in their guide by:

1. Using a properly sized wrench, loosen and back off locking nuts on each of the large bronze adjusting bolts as far as possible.
2. Back off the large bronze wedging bolts as far as possible.

**NOTE:** Items 1 and 2 above apply to gates with wedging bar assembly only.

3. For repair or replacement of J-seals or UHMW, remove all bolts holding clamping bars with a properly sized wrench. Remove clamping bars, J-seal and UHMW. Carefully label each part to record proper location and positioning.

**NOTE:** Do not throw old J-seal and/or UHMW away. Use the old J-seal and/or UHMW as a pattern for marking hole locations and lengths on replacement parts. Be sure to label new parts in the same manner as the ones being replaced. If necessary, new seals and UHMW can be ordered directly from our factory.

4. Make sure gate surfaces are clean and clear of obstructions. Mount new J-seal or UHMW in reverse order of dismounting instructions listed above. Remember, clamping bar always goes against J-seal. (Continued on next page...)

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5. If servicing the bottom seal, first raise the gate to a practical working height. Remove all bolts with a properly sized wrench and take off the clamping bar. Pull off old seal and use it as a pattern for punching holes and checking the length of the new bottom seal. Be sure to label seals and bars when dealing with more than one gate. Before remounting, make sure gate surface is clean and free from obstructions.

#### GATES SERVICED OUT OF GUIDES

Gates not accessible for maintenance may be removed from the guide and then serviced by the following steps: **NOTE:** Not all gate and guide assemblies are equipped with each of these parts. Follow the appropriate instructions for the given equipment and situation.

1. Using properly sized wrenches, remove stem cover, limit nut, handwheel, electric operator and lift nut assembly.
2. Some operators require the stem to be backed out of the threaded lift nut. This will require unbolting the stem from the gate and possibly unbolting the stem guides as well as pedestal anchorage. Once the stem has been backed out of the lift nut, remove the lift and the stem.
3. Standard handwheel lifts may be removed by unbolting from the head frame and unscrewing the lift nut off the top of the stem. Now the stem may be removed by detaching from the gate.
4. Once the lift assembly and stem have been removed, unbolt head frame from top plate. Also remove any remaining stem guides. If there is a wedging bar, follow instructions outlined under "Gates Serviced in Guides", Steps 1 and 2.
5. Using a suitable strong device (e.g. chain, cable, etc.) for the size and location of the gate, bolt to the stem mounting hardware on the gate and pull gate from guide. Be sure lifting device is properly situated and strong enough to handle the gate. Also, handle the gate with care so as not to damage the surface.
6. *For repair or replacement of J-seal and/or UHMW, see Steps 3 and 4 of "Gates Serviced in Guides".*

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#### SECTION IV: SERVICE NOTES

##### CALL PLASTI-FAB FIRST!!!

If a problem develops either in the installation, operation or performance of the equipment, the installation manual and drawings should be checked to determine if the equipment has been properly installed. If proper performance and operation cannot be obtained contact Plasti-Fab immediately. *Always reference the job number* so that we may locate the project records and better assist you.

##### Company may be contacted at:

Plasti-Fab, Inc.

P. O. Box 100

Tualatin, OR 97062

Phone: 503- 692-5460

Fax: 503- 692-1145

E-mail [sales@plasti-fab.com](mailto:sales@plasti-fab.com)

Web [www.plasti-fab.com](http://www.plasti-fab.com)

##### Our area representative is:

Phone:

Fax:

##### FIELD SERVICE

If necessary, arrangements can be made to send a technician to the job site. This technician will make a thorough examination of the problem and if the equipment is defective in workmanship or material, the necessary repairs or adjustment will be made by the factory at no cost to the purchaser. If, however, the problem is due to faulty installation or adjustment, the cost of field service will be charged to the purchaser.

##### UNAUTHORIZED REPAIRS OR BACK-CHARGES

Plasti-Fab, Inc. will not accept any unauthorized alterations, repairs or back-charges to its equipment without prior written notice and agreement.

The company will not be liable for contingent costs or costs of delay due to faulty equipment or the repairs thereof.

##### SPARE PARTS

Unless required by project specifications and shown on appendix attached, no spare parts have been supplied for this equipment. Should it become necessary to replace a part, refer to enclosed installation and detail drawings for appropriate part. If electric motor operated lifts or cylinder operators have been supplied, see separate Manufacturer's O & M Manual for details. See section on "Field Service" for telephone number to call when ordering parts.

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#### SPECIAL TOOLS

The installation and adjustment of Plasti-Fab gates and equipment requires no special tools and can be accomplished using a minimum of the following standard tools:

1. Adjustable (crescent wrenches) (2 required)
2. Open and box end wrenches are preferred
3. Allen wrenches

While these are the minimum tools required, installation time can be greatly decreased with such standard tools as socket wrenches and box wrenches.

If electric motor operated lifts or cylinder operators are supplied, see separate Manufacturer's O & M manual for special tools

#### LUBRICATION CROSS REFERENCE CHART

##### 1. STEMS

###### LUBRICANT

Molykote Type G

Valvoline Wal-Lith #2EP

No. 52 grease

Dura Lith #2

Lubriplate #630-2

Gulf Crown EP2

Mobilox Grease #2EP

Mobil Grease #4

Alvania #2EP

MultiFak #2EP

Tycol Azepro #11

###### MANUFACTURER

Alpha Molykote Co.

Ashland Oil & Refining Co.

Atlantic Richfield (ARCO)

Chevron Oil Co.

Fiske Brothers Refining Co.

Gulf Oil Co.

Mobil Oil Co.

Mobile Oil Co.

Shell Oil Co.

Texaco Oil Co.

Tidewater Oil Co.

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**2. LIFTS** (Also Aux. Gearboxes and Universal Couplings)

**LUBRICANT**

Lubriplate Type 630-AA

Mobilplex #45

Mobil Grease Special

Zeneplex II

**MANUFACTURER**

Fiske Brothers Refining Co.

Mobil Oil Co.

Mobil Oil Co.

Pennwalt Keystone Co.

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☐ Requires Review and Approval by General Contractor (E)  
This stamp is used in conjunction with the HGM CONTRACTOR  
SUBMITTAL TRANSMITTAL FORM and all the information and  
responsibilities contained within that form. HGM Associates Inc.  
Reviewed by: ZMN Date: 12-3-14

Please consult your local representative or contact Plasti-Fab, Inc., PO Box 100, Tualatin, Oregon, 97062.

PHONE 503-692-5460 FAX 503-692-1145 E-MAIL SALES@PLASTI-FAB.COM WEB WWW.PLASTI-FAB.COM



- ☒ Reviewed (A)   
☐ Reviewed-See Reviewer Comments-Resubmittal not Required (B)  
☐ Revise and Resubmit (C)  
☐ Not Required for Review (D)  
☐ Requires Review and Approval by General Contractor (E)
- This stamp is used in conjunction with the HGM CONTRACTOR SUBMITTAL/TRANSMITTAL FORM and all the information and responsibilities contained within that form. HGM Associates Inc.  
Reviewed by: ZMN Date: 12-3-14



## LIMITED WARRANTY

Every effort is made to assure that our customers receive the highest quality merchandise, free of any defects in materials and workmanship. This merchandise has been designed for use in accordance with the project specifications, and the standards and/or instructions recommended by this catalog, or other written quotation of this firm. However, no warranty, expressed or implied, is made other than as follows:

When installed and operated correctly, Plasti-Fab guarantees this merchandise for 25 full years against functional failure due to corrosion of composite materials, and 24 full months against failure due to any defects in material and workmanship. Such warranty can only be enforced by the product end user. During the warranty period any defects in material or workmanship will be repaired or replaced at Plasti-Fab, Inc.'s option at no cost to the end user. Warranty specifically excludes damage due to improper handling, storage, misuse or neglect.

Measure of damage is the price of defective material only. No charges for labor or expense required to remove or replace defective material, or for any consequential damages, will be allowed. Any implied warranty of merchantability or fitness is limited to the 24 months duration of this written warranty. To the extent allowed by law, neither Plasti-Fab, Inc. nor its selling dealer or agent shall have any responsibility for loss of use of the product, loss of time, commercial loss or consequential damages.

A "pass-through" warranty is offered for products that are manufactured by other companies and furnished as a component part of a Plasti-Fab product. Typical examples of such products include, but are not limited to: air conditioning units, electric actuators and gearboxes, thermostats, solenoids, gages, controllers, heaters, blowers, and fans. Warranties on these products are pass-through, meaning the equipment warranty will be limited to that offered by the equipment's original manufacturer.

This warranty gives specific legal rights. Other rights vary from state to state and by country. In the event a warranted product is believed defective, please notify Plasti-Fab, Inc. Refer to Plasti-Fab job number, print number, installation location, address and telephone numbers listed in the O&M manual when requesting assistance. Provide date purchased and copy of invoice or shipping documents if possible.

It is the policy of this company to encourage the settlement of disputes in an informal manner, and if such disputes arise over a warranty claim, an informal dispute settlement mechanism can be agreed upon at that time.

Please consult your local representative or contact Plasti-Fab, Inc., PO Box 100, Tualatin Oregon 97062  
PHONE 503.692.5460 FAX 503.692.1145 E-MAIL SALES@PLASTI-FAB.COM WEB WWW.PLASTI-FAB.COM



## **SHEETPILE INSPECTION**

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## Sheet Pile Retaining Wall Inspection

The main components for inspection of the sheet pile retaining wall include the steel sheeting, the anchorage at the face of sheeting connecting the sheeting to the soil anchor, the interlocks which connect individual sheets along the entire height of the sheets, and the wall toe protection conditions. These items should be monitored for signs of misalignment, corrosion, settlement and scour, cavity formation, interlock separation, holes, dents, and cracks. Below is a table of each component and the distresses which may affect them, a detailed description of each distress is discussed in the following sections:

Sheet Pile Wall Component	Distress					
	Misalignment	Corrosion	Holes, Dents, & Cracks	Interlock Separation	Settlement & Scour	Cavity Formation
Steel Sheeting	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
Anchorage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
Interlocks		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
Wall Toe	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Common inspection tasks include the following:

- Inspect sheeting for integrity of interlocks. Monitor for signs of impact damage causing deformation or partial breakage of the sheet pile wall. Deformations may be visible by bulging, necking, bow buckling, or S buckling of the sheets.
- Inspect sheeting for integrity of interlocks. Monitor for signs of impact damage causing deformation or partial breakage of the sheet pile wall. Deformations may be visible by bulging, necking, bow buckling, or S buckling of the sheets.
- Inspect sheeting for corrosion or abrasion of the sheet pile wall. Corrosion may be evident through visible thinning, rusting, pitting, or perforating of the steel surface. Ensure that gaps between mating surfaces are inspected for indications of crevice corrosion as well.
- Inspect sheeting for fatigue cracking of metal.
- Inspect anchorage connections at face of sheeting for evidence of corrosion or other deteriorated conditions.
- Inspect toe of sheet pile wall for evidence of loss of ground through foundation settlement or bottom scour.

### Misalignment

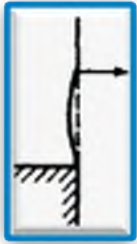
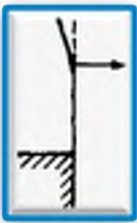



Misalignment is defined as deviation of the sheet pile from the initial design alignment. This can occur both horizontally and vertically. Misalignment indicates significant structural issues thereby reducing the safety of the structure.

#### Cause(s)

- Structural failure of sheet or anchor
- Soil failure at toe, causes creep of wall toe
- Horizontal sliding
- Seepage through joints of the sheet pile

## Identifications

- Sheet and Anchor: Bow or curvature that is noticeable for a considerable length within the sheet wall or anchor, may be one of the following:

Type of Misalignment	Example
<b>Bulging</b>	
<b>Necking</b>	
<b>Bow Buckling</b>	
<b>S-Buckling</b>	
<b>Wall Toe Migration</b>	
<p>Photo References:</p> <p>US Army Corps of Engineers Department of the Army. (1989, June). User's Manual: Inspection and Rating of Sheet Pile Structures (Technical Report No. REMR-OM-3) (L. Griemann &amp; J. Ste, Authors). Ames, IA: Engineering Research Institute, Iowa State University</p> <p>Petele, M. (Ed.). (2003). Slender Strut (Column) Buckling. Retrieved October 15, 2014, from Mechanical, Industrial and Technical Calculations website: <a href="http://www.mitcalc.com/doc/buckling/help/en/buckling.htm">http://www.mitcalc.com/doc/buckling/help/en/buckling.htm</a></p>	

## Method of Inspection

- Equipment: Tape Measurer, Line, Level, Straightedge
- Record accurate location of displacement
- Measure the dimensions of the misalignment
- Document this measurement to provide a log for future inspections to determine the rate and severity of misalignment

## Minimum Distress Allowance

Any measured misalignment greater than 2-3 in. should be noted. However, if another distress is recorded at that location, a misalignment, even if less than 3 in., should be recorded.

## Corrosion

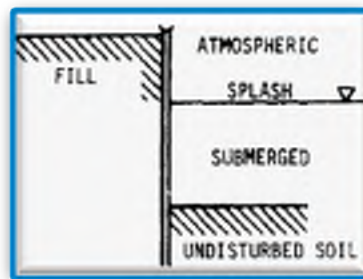
Corrosion is defined as the destruction of steel due to interaction with the environment. Causes weakening of sheet pile components.

## Cause(s)

Corrosion is caused by a chemical reaction which usually occurs when metals are alternately exposed to water and oxygen (or the atmosphere). Corrosion may occur more quickly if the water is of a low temperature and flow velocity and/or has a low pH, high sulfate concentration, high dissolved oxygen, and high concentration of dissolved solids, or ions. In soils, high moisture content or presence of bacteria will accelerate corrosion.







## Identification

- Corrosion is most commonly found in the atmospheric and splash zones as depicted below. It is important to note that not-exposed sheet wall components are also at great risk for corrosion; these zones include “Submerged” and “Undisturbed Soil.”



US Army Corps of Engineers Department of the Army. (1989, June).  
 User's Manual: Inspection and Rating of Sheet Pile Structures  
 (Technical Report No. REMR-OM-3) (L. Griemann & J. Ste, Authors).  
 Ames, IA: Engineering Research Institute, Iowa State University.

- Visual inspection should be compared to a set of standards or photos, an example guideline is given below.

Rating	Level	Description	Picture
<b>A</b>	0	New steel sheet pile	
<b>A</b>	1	Minor scaling or sparse small pits	
<b>M</b>	2	Considerable scaling and/or moderate pitting	
<b>M</b>	3	Dense pitting, thickness of sheet wall is reduced	
<b>U</b>	4	Reduced thickness of sheet wall is obvious	
<b>U</b>	5	Reduced thickness occurs along majority of sheet wall, holes have formed	

## Photo References:

US Army Corps of Engineers Office of the Secretary of Defense. (2009, December). DoD Corrosion Prevention and Control Program: In-Situ Coating for Sheet Piles (Technical Report No. FO-8-AR06) (A. D. Beitelman, E. Van Draege, & D. Rozene, Authors). Champaign, IL: US Army Engineer Research and Development Center

### Method of Inspection

- Equipment: Corrosion is a visual inspection, camera for photo documentation is suggested
- Compare observed corrosion condition to set standards, or photographs. The following is a guideline for such standards are above.
- Record level and/or rating on inspection sheet
- Photos of observed corrosion may be included if determined necessary

### Minimum Distress Allowance

Corrosion should be considered a hazard if it exceeds a Level 1 and falls into the M (Minimally Acceptable; Maintenance required) or U (Unacceptable) ratings. However, if another distress is recorded at that location any evidence of corrosion present should be recorded.

### Settlement or Scour

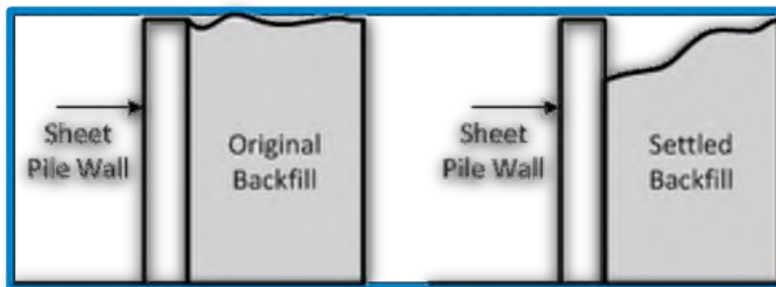
Settlement or scour is defined as the downward movement of soil behind the sheet pile. This may reduce the strength of the sheet pile wall or compromise the integrity of the anchor.

### Cause(s)

- Consolidation of soil
- Loss of backfill
- Wall movement

### Identification

- Soil appears to be inconsistent with surrounding soil grade conditions



- Note what the surface condition is at the location of the settlement
  - Is the backfill supporting a structure?
  - Is the backfill surface paved or has a sidewalk?
  - Is there nothing on the backfill surface?

### Method of Inspection

- Equipment: Tape measurer, Line, Level, Straightedge
- Record accurate location of observed settlement
- Record the surface condition at the location of the settlement
- Measure the depth and width beyond sheet pile of settlement and record on inspection sheet



### Minimum Distress Allowance

Any settlement greater than 4 inches in less than 10 feet of sheet pile wall height should be recorded. However, if another distress is recorded at that location, settlement, even if less than 4 in., should be recorded. Settlement also has maximum allowances based on length of the settlement along the sheet pile wall and the surface condition, as shown in the table below.

Length of Settlement and Surface Condition	Settlement Depth in
Supporting a structure	6
<20 feet and hard surfaced	18
>20 feet and hard surfaced	24
<20 feet and no surfacing	36
>20 feet and no surfacing	48

\*From Iowa State Manual

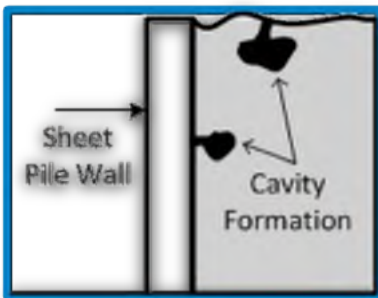
### Cavity Formation

Cavity formation is defined as the occurrence of voids in the soil behind sheet pile wall. This may cause settlement and reduce the strength of the sheet pile wall and anchors.

#### Cause(s)

- Holes in sheet
- Scour beneath sheet
- Wildlife

#### Identification



- Depressions or settlement on backfill surface
- Holes or apparent burrows on backfill surface or on sheet pile wall
- Note what the surface condition is at the location of the settlement
  - Is the backfill supporting a structure?
  - Is the backfill surface paved or has a sidewalk?
  - Is there nothing on the backfill surface?

#### Method of Inspection

- Equipment: Flashlight, Tape measurer, Length of bendable wire
- Record accurate location of cavity
- Insert wire into cavity to explore concealed sections of cavity and determine approximate height, length and width.

- Record cavity volume (length, height, width) on inspection sheet

### Minimum Distress Allowance

Cavities with a depth greater than 1 foot should be recorded. However, if another distress is recorded at that location cavities less than 1 foot depth or if conditions suggest the cavity is increasing in size. Cavities also have a maximum volume allowance shown in the table below:

Above Grade Surface Condition	ft <sup>3</sup>
No surfacing	27
Surfacing	8
Supported structure	3.5

### Interlock Separation

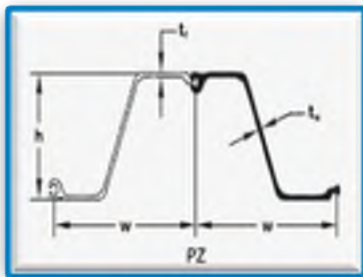
Interlock separation is defined as the breaking apart of the interlocks that connect adjacent sections of the sheet pile wall. This may cause weakening of the wall and lead to the formation of other distresses.

#### Cause(s)

- Shifting of sheet pile wall
- Settlement of backfill
- Corrosion
- Impact of debris

#### Identification

- An intact interlock should appear as the image below:



PZ Sheet Pile Datasheet [Fact sheet]. (n.d.). Retrieved 2014, from skylinesteel website:  
<http://www.skylinesteel.com/globalnav/technical-library/datasheets-autocads>

- Gaps between adjoining sheet will sections
- Interlocks that appear to be broken
- Corroded interlocks

#### Method of Inspection

- Equipment: Tape measurer
- Accurately record the location of the separation relative to the length of the sheet pile
- Accurately record the location of the interlock separation relative to the height of the sheet pile.
- Measure and record the total length of the interlock separation
- Note if the separation extends below the water surface

- To determine the length below the water surface feel below the surface or gather information when water level recedes.

### **Minimum Distress Allowance**

Any separation larger than 12 inches in length should be recorded. However, if another distress is recorded at that location a separation less than 12 inches should be recorded.

### **Holes, Dents, and Cracks**

Holes, dents and cracks account for any openings, depressions, indents, or fractures in or on the sheet pile wall. Generally will not impede the operation of the sheet pile, but large distresses or the cumulative effects of these three may reduce the safety of the structure.

#### **Cause(s)**

- Corrosion
- Impact of debris

#### **Identification**

- Corrosion
- Openings, indents or breaks in sheet pile wall

#### **Method of Inspection**

- Equipment: Tape measurer
- Accurately record the location of the distress
- Holes and Dents
  - Record height, width and shape
  - Record length if more than one section of wall is impacted
  - Dents you may also record the depth into the wall
- Cracks: record length of crack and direction (traverse or vertical)

### **Minimum Distress Allowance**

Record holes, dents or cracks if other distresses are also noted in the location using the following as minimum criteria.

- Holes: Record if sum of height and width is greater than 8 in.
- Dents: Record if sum of height and width is greater than 18 in.
- Cracks: Record if the length of the crack is greater than 6 in.

## **APPENDIX C – AS-BUILT WELL CURVES**

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# Industrial Park Levee- Council Bluffs, Iowa

## Well Pump Test Reports



## Well #1 Pump Test Report

Static Water Level: 16.57'

Pumping Rate: 70GPM

Date: 1/27/2016

Time: 9:30AM

### Well #1 (pumping Well)

MINUTES	DRAWDOWN	SANDTEST
1	10.43	
6	8.08	
13	8.03	
28	8.03	
45	7.98	
60	7.99	trace
90	7.95	trace

### Observation Well #1

MINUTES	DRAWDOWN
1	0.17
6	0.22
13	0.26
28	0.32
45	0.37
60	0.46
90	0.43

### Observation Well #2

MINUTES	DRAWDOWN
1	0.02
6	0.02
13	0.03
28	0.05
45	0.06
60	0.1
90	0.1

### Observation Well #3

MINUTES	DRAWDOWN
1	0
6	0
13	0.01
28	0.01
45	0.02
60	0.05
90	0.05





Griffin Dewatering Corporation  
6414 So. 84th Street  
Omaha, NE 68127  
(402) 331-5000

		Date:	1/25/2016
		Rig #:	4
Contractor	Judd Bros.	Driller:	Dave Lane
Job Address:	Council Bluffs Ia.	Helper:	Clayton Juston
		Branch:	Omaha
Job #:		Depth of Hole	60'
Dia of borehole:	24"	Length of well:	17'
Dia of well:	8"	Length of screen:	36 + 5' sump
Screen Type:	SS wire wrap	Well Yield:	
Revert Used:	1-gal	Total Footage Drilled today:	60'
Water Table:	11.5'	No. of wells installed today:	1

Delays - Explain: Breaking up frozen gravel pack in shipment bags

Drill hole = 60' deep Set bottom of casing at 57'

well # 1 far South well

### WELL LOG

Depth	Formation	Depth	Formation
0-4	fine dry sand		
4-11.5	dark clay		
11.5- 30	very fine brown sand		
30- 35	medium to coarse clean sand		
34- 45	fine gray clean sand		
45- 55	medium to fine clean sand		
55- 57	broken gray clay lense		
57 - 60	very fine gray sand		

Dave Lane

Driller

Verified Contractor

Pumping  
well

# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Ind. Park Levee Imp. Ph II</u>					LEVEE DISTRICT:				
LOCATION (STA): <u>222+50</u>					ELEV TOP OF RISER:			WELL NO: <u>83 d)</u>	
DATE: <u>1-27-16</u>			TIME TEST STARTED: <u>9:30</u>			TIME TEST COMPLETED: <u>11:15</u>			
TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
9:06	0	16.57	0	0	11:00	70	24.52	7.95	70
9:20	1	27	10.43	70					70
9:36	6	24.65	8.08	70					70
9:43	13	24.60	8.03	70					70
9:58	28	24.60	8.03	70					70
10:15	45	24.55	7.98	70					70
10:30	60	24.56	7.99	70					70
SAND INFILTRATION TEST									
DEPTH OF WELL: <u>57.23</u>					DEPTH TO SAND IN WELL BEFORE TEST: <u>57.1</u>			SAND IN WELL BEFORE TEST: <u>0</u>	
TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)	
DEPTH TO SAND IN WELL AFTER TEST: <u>57.23</u>		SAND IN WELL AFTER TEST: <u>0</u>				SAND IN WELL AFTER CLEANING: <u>0</u>			
REMARKS: <u>Compressor shut down at 11:15</u>									

#1 Test  
-South End well

, 13

# RELIEF WELL PUMPING TEST REPORT

[illegible]

WES FORM 796  
MAR '53  
REVISED OCT '53

INSPECTOR

93<sup>i</sup> 10<sup>n</sup>

# RELIEF WELL PUMPING TEST REPORT

[illegible]

WES FORM 796  
MAR '53  
REVISED OCT '53

INSPECTOR

166-3"



# RELIEF WELL PUMPING TEST REPORT

PROJECT:					LEVEE				
LOCATION					DISTRICT:				
(STA):				ELEV TOP OF RISER:				WELL NO: <b>#-3</b>	
DATE: <b>1-27-16</b>				TIME TEST STARTED: <b>9:30</b>			TIME TEST COMPLETED: <b>11:15</b>		
TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
<b>9:09</b>	<b>0</b>	<b>13.8</b>	<b>0</b>	<b>70</b>	<b>11:04</b>	<b>44</b>	<b>13.85</b>	<b>.05</b>	<b>70</b>
<b>9:34</b>	<b>4</b>	<b>13.80</b>	<b>0</b>	<b>1</b>					
<b>9:40</b>	<b>10</b>	<b>13.80</b>	<b>0</b>	<b>1</b>					
<b>9:46</b>	<b>16</b>	<b>13.81</b>	<b>.01</b>	<b>1</b>					
<b>10:02</b>	<b>32</b>	<b>13.81</b>	<b>.01</b>	<b>1</b>					
<b>10:19</b>	<b>49</b>	<b>13.82</b>	<b>.02</b>	<b>1</b>					
<b>10:27</b>	<b>67</b>	<b>13.85</b>	<b>.05</b>	<b>1</b>					
SAND INFILTRATION TEST									
DEPTH OF WELL:				DEPTH TO SAND IN WELL BEFORE TEST:			SAND IN WELL BEFORE TEST:		
TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)	
DEPTH TO SAND IN WELL AFTER TEST:				SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:		
REMARKS:									

WES FORM 796  
MAR '53  
REVISED OCT '53

INSPECTOR

244' 5"

## Sand Infiltration Test

PROJECT: CB Lane ph 2  
JOB LOCATION: 1 B, 2 A  
JOB #:   
CLIENT: Jollys Bros.

WELL #: 01  
WELL DEPTH (ft): 57.1  
OPERATOR:  
INSPECTOR:  
DATE: 1-27-16

PUMP TEST START TIME: 9:30

[illegible]

\* Outlet valve should be calibrated to 0.5 GPM

Maximum Allowable sanding rate is 1pt / 25000 gal ~ 5ppm (parts per million)

If sanding rate exceeds specifications, describe measures taken between tests:

[illegible]



## Well #2 Pump Test Report

Static Water Level: 15.80'

Pumping Rate: 70GPM

Date: 3/10/2016

### Well #2 (pumping Well)

MINUTES	DRAWDOWN	SANDTEST
5	5.4	
20	5.53	
45	5.57	30min. trace
60	5.65	trace

### Relief Well #3

MINUTES	DRAWDOWN
5	0.15
20	0.22
45	0.25
60	0.25

### Relief Well #1

MINUTES	DRAWDOWN
5	0.1
20	0.14
45	0.2
60	0.2





Griffin Dewatering Corporation  
6414 So. 84th Street  
Omaha, NE 68127  
(402) 331-5000

Date: 3/8/2016

Rig #: 4

Contractor: Judd Brothers

Driller: Clayton

Job Address: Council Bluffs Ia.

Helper: Nick

South side of job

Branch: Omaha

Job #: \_\_\_\_\_

Depth of Hole 60'

Dia of borehole: 24"

Length of well: 16'

Dia of well: 8"

Length of screen: 37' +5' bottom

Screen Type: SS

Well Yield: \_\_\_\_\_

Revert Used: 2-gal

Total Footage Drilled today: 60'

Water Table: 14'

No. of wells Installed today: 1

Delays - Explain: 57' casing in ground drilled hole to 60'

Well #2

South side

### WELL LOG

Depth	Formation	Depth	Formation
0-4	silty sand		
4-15'	fine silty sand		
15-35	fine gray sand		
35-40	medium to coarse sand		
40-50	medium to coarse sand		
50-55	fine sand		
55-60	medium sand		

Clayton Wheaton

Driller

Dave Lane

Suprtintendent

Pumping well

## RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Judds Bros. Relief wells</u>					LEVEE DISTRICT: <u>Council Bluffs, IA</u>				
LOCATION (STA): <u>Amanistar</u>				ELEV TOP OF RISER:			WELL NO: <u>2</u>		
DATE: <u>3-10-2016</u>			TIME TEST STARTED:			TIME TEST COMPLETED:			
TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
	0	15.8		70					
	5	21.2	5.4	70					
	20	21.35	5.55	70					
	45	21.37	5.57	70					
	60	21.45	5.65	70					
0 SAND INFILTRATION TEST									
DEPTH OF WELL:				DEPTH TO SAND IN WELL BEFORE TEST:			SAND IN WELL BEFORE TEST:		
TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)	
DEPTH TO SAND IN WELL AFTER TEST:			SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:			
REMARKS:									

WES FORM 796

MAR '53

REVISED OCT '53

INSPECTOR

# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Judds Bros. Relief wells</u>					LEVEE DISTRICT: <u>Council Bluffs, IA</u>				
LOCATION (STA): <u>Ameristar</u>				ELEV TOP OF RISER:			WELL NO: <u>3</u>		
DATE: <u>3-10-2014</u>			TIME TEST STARTED:			TIME TEST COMPLETED:			

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
	0	12.4		0					
	5	13.55	0.15	0					
	20	13.62	0.22	0					
	45	13.65	0.25	0					
	60	13.65	0.25	0					

D. Surface 50"
SAND INFILTRATION TEST

DEPTH OF WELL:		DEPTH TO SAND IN WELL BEFORE TEST:			SAND IN WELL BEFORE TEST:			
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TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST:			SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:		
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REMARKS:

# RELIEF WELL PUMPING TEST REPORT

PROJECT: Judds Bros. Relief Wells						LEVEE DISTRICT: Council Bluffs, IA					
LOCATION (STA): Amonistar				ELEV TOP OF RISER:				WELL NO: 1			
DATE: 3-10-2016				TIME TEST STARTED:				TIME TEST COMPLETED:			
TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM		
	0	16.8		0							
	5	16.9	0.1	0							
	20	16.94	0.14	0							
	45	17	0.2	0							
	60	17		0							
D. Stanley 79' SAND INFILTRATION TEST											
DEPTH OF WELL:				DEPTH TO SAND IN WELL BEFORE TEST:				SAND IN WELL BEFORE TEST:			
TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)			
DEPTH TO SAND IN WELL AFTER TEST:				SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:				
REMARKS:											

WES FORM 796

MAR '53

REVISÉD OCT '53

INSPECTOR

### Sand Infiltration Test

PROJECT: Judds Relief Wells  
JOB LOCATION: Cancer Bluffs, IA  
JOB #: 0D1251  
CLIENT: Judds / City of CB

WELL #: 2  
WELL DEPTH (ft): \_\_\_\_\_  
OPERATOR: \_\_\_\_\_  
INSPECTOR: \_\_\_\_\_  
DATE: \_\_\_\_\_

PUMP TEST START TIME:

[illegible]

\* Outlet valve should be calibrated to 0.5 GPM

Maximum Allowable sanding rate is 1pt / 25000 gal ~ 5ppm (parts per million)

If sanding rate exceeds specifications, describe measures taken between tests:



## Well #3 Pump Test Report

Static Water Level: 13.4

Pumping Rate: 70GPM

Date: 3/10/2016

### Well # 3 (pumping Well)

MINUTES	DRAWDOWN	SANDTEST
5	5.5	
20	7.7	
45	7.45	30min. trace
60	7.3	trace

### Relief Well #2

MINUTES	DRAWDOWN
5	0.16
20	0.16
45	0.24
60	0.24

### Observation Well #2

MINUTES	DRAWDOWN
5	0.18
20	0.18
45	0.22
60	0.22



Griffin Dewatering Corporation  
6414 So. 84th Street  
Omaha, NE 68127  
(402) 331-5000

Date: 3/9/2016

Rig #: 3905

Contractor: Judd Brothers

Driller: Clayton

Job Address: Council Bluffs Ia.

Helper: Brian Nick

Branch: Omaha

Job #: \_\_\_\_\_

Depth of Hole: 60'

Dia of borehole: 24"

Length of well: 16'

Dia of well: 8"

Length of screen: 37 + 5' bottom

Screen Type: SS

Well Yield: \_\_\_\_\_

Revert Used: 2 gal

Total Footage Drilled today: \_\_\_\_\_

Water Table: 10

No. of wells installed today: 1

Delays - Explain: 57' casing set in 60' hole

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

  
well ● South side

### WELL LOG

Depth	Formation	Depth	Formation
0-4	silty sand		
4-20'	fine dirty sand		
20-25	medium to coarse sand		
25-40	fine to medium sand		
40-50	fine clean sand		
50-55	medium sand		
55-60	fine sand		

Clayton

Driller

Dave Land

Superintendent



Pumping well

# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Judds Bros. Relief wells</u>					LEVEE DISTRICT: <u>Council Bluffs, IA</u>				
LOCATION (STA): <u>Ameristar</u>				ELEV TOP OF RISER:			WELL NO: <u>3</u>		
DATE: <u>3-10-2016</u>			TIME TEST STARTED: <u>9:15 A.M.</u>			TIME TEST COMPLETED: <u>10:15 A.M.</u>			
TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
	<u>0</u>	<u>13.4</u>		<u>70</u>					
	<u>5</u>	<u>18.9</u>	<u>5.5</u>	<u>70</u>					
	<u>20</u>	<u>21.1</u>	<u>7.7</u>	<u>70</u>					
	<u>45</u>	<u>20.85</u>	<u>7.45</u>	<u>70</u>					
	<u>60</u>	<u>20.7</u>	<u>7.3</u>	<u>70</u>					
0 SAND INFILTRATION TEST									
DEPTH OF WELL:				DEPTH TO SAND IN WELL BEFORE TEST:			SAND IN WELL BEFORE TEST:		
TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)	
DEPTH TO SAND IN WELL AFTER TEST:				SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:		
REMARKS:									

WES FORM 796

MAR '53

REVISED OCT '53

INSPECTOR

# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Judds Bros. Relief wells</u>					LEVEE DISTRICT: <u>Council Bluffs, IA</u>				
LOCATION (STA): <u>Amanistaw</u>				ELEV TOP OF RISER:			WELL NO: <u>2</u>		
DATE: <u>3-10-2016</u>			TIME TEST STARTED: <u>9:15 AM</u>			TIME TEST COMPLETED: <u>10:15 AM</u>			

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
	0	15.84		0					
	5	16	0.16	0					
	20	16	0.16	0					
	45	16.08	0.24	0					
	60	16.08	0.24						

0.5 ft/sec 49% SAND INFILTRATION TEST

DEPTH OF WELL:		DEPTH TO SAND IN WELL BEFORE TEST:			SAND IN WELL BEFORE TEST:			
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TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST:			SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:		
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REMARKS:

# RELIEF WELL PUMPING TEST REPORT

[illegible]

WES FORM 796  
MAR '53  
REVISED OCT '53

INSPECTOR

## 11

WELL #: 3  
WELL DEPTH (ft):  
OPERATOR:  
INSPECTOR:  
DATE:

PUMP TEST START TIME:

[illegible]

\* Outlet valve should be calibrated to 0.5 GPM  
Maximum Allowable sanding rate is 1pt / 25000 gal ~ 5ppm (parts per million)

If sanding rate exceeds specifications, describe measures taken between tests:

*[Faint handwriting on lined paper]*



## Well #4 Pump Test Report

Static Water Level: 15.6

Pumping Rate: 200GPM

Date: 3/16/2016

### Well #4 (pumping Well)

MINUTES	DRAWDOWN	SANDTEST
15	10.84	
30	10.92	
60	10.92	30min. trace
90	11	trace

### Relief Well #5

MINUTES	DRAWDOWN
15	0.79
30	0.83
60	0.87
90	0.91

### Relief Well #3

MINUTES	DRAWDOWN
30	0.15
60	0.15
90	0.19



Griffin Dewatering Corporation  
6414 So. 84th Street  
Omaha, NE 68127  
(402) 331-5000

Date: 3/14/2016

Rig #: 3905

Contractor Judd Brothers

Driller: Derek

Job Address: CB la.

Helper: Gerrett

Relief Well job

Branch: Omaha Ne.

Job #: \_\_\_\_\_

Depth of Hole 60'

Dia of borehole: 24"

Length of well: \_\_\_\_\_

Dia of well: 8"

Length of screen: 57' of screen & casing

Screen Type: SS

Well Yield: \_\_\_\_\_

Revert Used: 2 gal

Total Footage Drilled today: 60'

Water Table: 10'

No. of wells installed today: 1

Delays - Explain:

Could not set rig on next location and install surface tube for tomorrow. Waiting on survey crew.

### WELL LOG

Depth	Formation	Depth	Formation
0-10	silty sandy soil		
10-22'	fine brown sand		
22-28'	coarse sand		
28-45	medium to fine clean sand		
45-55	fine gray sand		
55-58	medium sand		
58-59	blue clay		
59-60	silty sandy clay lense		

Derek Burt

Driller

Dave Lane

Superintendent

*pumping well*

74100

# RELIEF WELL PUMPING TEST REPORT

PROJECT: <i>Griddle Relief Well</i>				LEVEE DISTRICT:	
LOCATION (STA):			ELEV TOP OF RISER:		WELL NO: <i>(Circled X)</i>
DATE: <i>3-16-16</i>		TIME TEST STARTED: <i>11:25 AM</i>		TIME TEST COMPLETED:	

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
<i>11:25</i>		<i>15.6'</i>		<i>200</i>					
<i>11:40</i>	<i>15 min</i>	<i>26.4'</i>	<i>10.84</i>						
<i>11:55</i>	<i>30</i>	<i>26.5'</i>	<i>10.92</i>						
<i>12:25</i>	<i>60 min</i>	<i>26.5'</i>	<i>10.92</i>						
<i>12:55</i>	<i>90 min</i>	<i>26.6'</i>	<i>11.00</i>						

*pumping well*

SAND INFILTRATION TEST			
DEPTH OF WELL:		DEPTH TO SAND IN WELL BEFORE TEST:	
		SAND IN WELL BEFORE TEST:	

TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST:	SAND IN WELL AFTER TEST:	SAND IN WELL AFTER CLEANING:
REMARKS:		



# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Sadd's Relief Well</u>				LEVEE DISTRICT: <u>#5</u>			
LOCATION (STA):				ELEV TOP OF RISER:		WELL NO: <u>1st</u>	
DATE: <u>3-16-16</u>		TIME TEST STARTED: <u>11:25</u>		TIME TEST COMPLETED:			

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
<u>5:10</u>	<u>11:25</u>	<u>15' 7 1/2"</u>		<u>200</u>					
<u>11:40</u>	<u>15</u>	<u>16' 5"</u>	<u>0.79</u>			<u>15 min</u>			
<u>11:55</u>	<u>30</u>	<u>16' 5 1/2"</u>	<u>0.83</u>			<u>30 min</u>			
<u>12:25</u>	<u>66</u>	<u>16' 6"</u>	<u>10.87</u>			<u>66</u>			
<u>12:55</u>	<u>90</u>	<u>16' 6 1/2"</u>	<u>0.41</u>			<u>90</u>			

3.4 7.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0

DEPTH OF WELL:		DEPTH TO SAND IN WELL BEFORE TEST:		SAND IN WELL BEFORE TEST:	
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TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST:		SAND IN WELL AFTER TEST:		SAND IN WELL AFTER CLEANING:	
REMARKS:					

# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>5 adds</u>					LEVEE DISTRICT:				
LOCATION (STA):				ELEV TOP OF RISER:			WELL NO: <u>X 3</u>		
DATE: <u>3-16-16</u>			TIME TEST STARTED: <u>11:25</u>			TIME TEST COMPLETED:			

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
<u>5:10</u>	<u>11:25</u>	<u>13' 6"</u>		<u>200</u>					
<u>11:55</u>	<u>30 min</u>	<u>13' 8"</u>	<u>0.15</u>						
<u>12:25</u>	<u>60</u>	<u>13' 8"</u>	<u>0.15</u>						
<u>12:55</u>	<u>90 min</u>	<u>13' 8"</u>	<u>0.19</u>						

112' AWAY SAND INFILTRATION TEST

DEPTH OF WELL:		DEPTH TO SAND IN WELL BEFORE TEST:			SAND IN WELL BEFORE TEST:		
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TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST:		SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:			
REMARKS:								

## Sand Infiltration Test

PROJECT: \_\_\_\_\_  
 JOB LOCATION: \_\_\_\_\_  
 JOB #: \_\_\_\_\_  
 CLIENT: \_\_\_\_\_

WELL #: 4  
WELL DEPTH (ft): \_\_\_\_\_  
OPERATOR: \_\_\_\_\_  
INSPECTOR: \_\_\_\_\_  
DATE: \_\_\_\_\_

PUMP TEST START TIME: \_\_\_\_\_

[illegible]

\* Outlet valve should be calibrated to 0.5 GPM

Maximum Allowable sanding rate is 1pt / 25000 gal ~ 5ppm (parts per million)

If sanding rate exceeds specifications, describe measures taken between tests:

[illegible]



## Well #5 Pump Test Report

Static Water Level: 17.67

Pumping Rate: 100GPM

Date: 3/16/2016

### Well #5 (pumping Well)

MINUTES	DRAWDOWN	SANDTEST
15	9.62	
30	9.66	
60	9.41	30min. trace
90	9.41	trace

### Relief Well #4

MINUTES	DRAWDOWN
15	0.29
30	0.5
60	0.5
90	0.54

### Relief Well #3

MINUTES	DRAWDOWN
15	0
30	0
60	0.05
90	0.05



Griffin Dewatering Corporation  
6414 So. 84th Street  
Omaha, NE 68127  
(402) 331-5000

Date: 3/15/2016

Rig #: 3905

Contractor: Judd Brothers

Driller: Oerek

Job Address: Council Bluffs

Helper: Gerrett

Relief Wells

Branch: Omaha

Job #:

Depth of Hole 60'

Dia of borehole: 24"

Length of well: 57' of casing & screen

Dia of well: 8"

Length of screen: \_\_\_\_\_

Screen Type: SS

Well Yield: \_\_\_\_\_

Revert Used: 2 gal

Total Footage Drilled today: 60'

Water Table: 10'

No. of wells installed today: 1

Delays - Explain: Muddy job site today after rain last night

Well # 5  
8th well

### WELL LOG

Depth	Formation	Depth	Formation
0-10	soft silty sandy clay		
10-25'	fine brown sand		
25-30	coarse sand		
30-55	clean medium sand		
55-58	fine sand		
58-59	clay		
59-60	soft clay lense & fine sand		

Oerek

Driller

Dave Land

Superintendent

# RELIEF WELL PUMPING TEST REPORT

Pumping

PROJECT: Levee Relief Wells LEVEE DISTRICT: #5

LOCATION (STA): C.B.I.A. ELEV TOP OF RISER:  WELL NO: 8 *2nd well*

DATE: 3-16-16 TIME TEST STARTED: 2:00 PM TIME TEST COMPLETED:

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
2:00	START	17' 8"							
2:15	15 min	27' 3"	4.62						
2:30	30 min	27' 4"	4.66						
3:00	60 min	27' 1"	4.41						
3:30	90 min	27' 1"	4.41						

SAND INFILTRATION TEST

DEPTH OF WELL:  DEPTH TO SAND IN WELL BEFORE TEST:  SAND IN WELL BEFORE TEST:

TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST:  SAND IN WELL AFTER TEST:  SAND IN WELL AFTER CLEANING:

REMARKS:

WES FORM 796  
MAR '53  
REVISED OCT '53

INSPECTOR

# RELIEF WELL PUMPING TEST REPORT

34" *any*  
7

PROJECT: <i>Judds Relief Wells</i>				LEVEE DISTRICT:					
LOCATION (STA): <i>C.B.T.A.</i>				ELEV TOP OF RISER:				WELL NO: <i>4</i>	
DATE: <i>3-16-16</i>				TIME TEST STARTED: <i>2:00 pm</i>				TIME TEST COMPLETED:	

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
<i>2:00</i>	<i>Static</i>	<i>15' 6"</i>		<i>100</i>					
<i>2:15</i>	<i>15 min</i>	<i>15' 9"</i>	<i>0.29</i>						
<i>2:30</i>	<i>30 min</i>	<i>16' 0"</i>	<i>0.50</i>						
<i>3:00</i>	<i>1 hr</i>	<i>16' 0"</i>	<i>0.50</i>						
<i>3:30</i>	<i>1.5 hr</i>	<i>16' 1/2"</i>	<i>0.54</i>						

*34" any* SAND INFILTRATION TEST

DEPTH OF WELL:		DEPTH TO SAND IN WELL BEFORE TEST:				SAND IN WELL BEFORE TEST:		
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TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST:			SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:		
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REMARKS:



Well 3 146' away  
~~Sand Infiltration Test~~

PROJECT: \_\_\_\_\_  
 JOB LOCATION: \_\_\_\_\_  
 JOB #: \_\_\_\_\_  
 CLIENT: \_\_\_\_\_

WELL #: 3  
 WELL DEPTH (ft): \_\_\_\_\_  
 OPERATOR: \_\_\_\_\_  
 INSPECTOR: \_\_\_\_\_  
 DATE: \_\_\_\_\_

PUMP TEST START TIME: \_\_\_\_\_

TEST #	TIME (min) (start/stop)	FLOWMETER READING (FLOW) (start/stop)	PUMPING RATE (gpm)	LENGTH OF TEST (min)	OUTLET VALVE FLOW (GPM)*	ROSSUM READING ml	SANDING RATE ml / min	CONVERSION FACTOR RATE * 528	SANDING RATE (ppm)
1									
2:40	Static	13" 7"							
2:15	15 min	13" 7"							
2:30	30 min	13" 7"							
3:00	40 min	13" 7 1/2"							
3:30	90 min	13" 7 1/2"							

\* Outlet valve should be calibrated to 0.5 GPM  
 Maximum Allowable sanding rate is 1pt / 25000 gal ~ 5ppm (parts per million)

If sanding rate exceeds specifications, describe measures taken between tests:

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## Sand Infiltration Test

PROJECT: \_\_\_\_\_  
 JOB LOCATION: \_\_\_\_\_  
 JOB #: \_\_\_\_\_  
 CLIENT: \_\_\_\_\_

WELL #: 5  
WELL DEPTH (ft): \_\_\_\_\_  
OPERATOR: \_\_\_\_\_  
INSPECTOR: \_\_\_\_\_  
DATE: \_\_\_\_\_

**PUMP TEST START TIME:**

[illegible]

\* Outlet valve should be calibrated to 0.5 GPM

Maximum Allowable sanding rate is 1pt / 25000 gal ~ 5ppm (parts per million)

If sanding rate exceeds specifications, describe measures taken between tests:

1. *What is the main purpose of the study?*  
 2. *What are the research objectives?*  
 3. *What is the research methodology?*  
 4. *What are the findings of the study?*  
 5. *What are the conclusions of the study?*  
 6. *What are the limitations of the study?*  
 7. *What are the implications of the study?*  
 8. *What are the future research directions?*  
 9. *What are the contributions of the study?*  
 10. *What are the key words of the study?*



## Well #6 Pump Test Report

Static Water Level: 13.00'

Pumping Rate: 70GPM

Date: 1/27/2016

Time: 1:05PM

### Well #6 (pumping Well)

MINUTES	DRAWDOWN	SANDTEST
5	10	
10	12.45	
30	11.4	
45	10	
60	9.7	
90	9.45	trace
120	9.3	trace

### Observation Well #4

MINUTES	DRAWDOWN
5	0.25
10	0.31
30	0.4
45	0.45
60	0.49
90	0.55
120	0.56

### Observation Well #5

MINUTES	DRAWDOWN
5	0.12
10	0.14
30	0.18
45	0.27
60	0.27
90	0.27
120	0.36



Griffin Dewatering Corporation  
6414 So. 84th Street  
Omaha, NE 68127  
(402) 331-5000

Date: 1/27/2016

Rig #: 4

Contractor: Judd Brothers

Driller: Dave L

Job Address: Council Bluffs Ia

Helper: Derek B

Ameristar

Branch: Omaha Ne.

Job #: \_\_\_\_\_

Depth of Hole 60'

Dia of borehole: 24"

Length of well: \_\_\_\_\_

Dia of well: 8"

Length of screen: 37'

Screen Type: SS - wire wrap

Well Yield: \_\_\_\_\_

Revert Used: 1 gal

Total Footage Drilled today: 60'

Water Table: 12'

No. of wells installed today: 1

Delays - Explain: gravel pack frozen in shipping bags

Set bottom of casing at 37'

well #6

~~Well 2~~ North end

### WELL LOG

Depth	Formation	Depth	Formation
0-2	top soil		
2-3'	gravel fill		
3-10'	gray clay		
10-12'	fine dry sand "12' water table"		
12-30'	fine brown sand		
30-34	coarse sand, trace gravel		
34-45	medium to fine sand		
45-49	coarse sand		
49-53	fine gray sand		
53-54	light gray clay lense		
54-60	fine gray sand = TD		

Dave Lane

Driller

Verified Contractor

Test

Bp  
Anwister

WES FORM 796  
MAR '53  
REVISED OCT '53

INSPECTOR

ORS well  
#4

WES FORM 796  
MAR '53  
REVISED OCT '53

40.5

# RELIEF WELL PUMPING TEST REPORT

PROJECT:					LEVEE									
LOCATION (STA):					DISTRICT:									
ELEV TOP OF RISER:					WELL NO: <u>P-2</u>									
DATE:					TIME TEST STARTED:					TIME TEST COMPLETED:				
TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM					
1:07	2	11.43	.0	70	3:09	124	11.79	.36	70					
1:14	9	11.55	.12	70										
1:19	14	11.57	.14	70										
1:24	29	11.61	.18											
1:54	49	11.7	.27											
2:07	62	11.7	.27											
2:37	92	11.7	.27											
SAND INFILTRATION TEST														
DEPTH OF WELL:					DEPTH TO SAND IN WELL BEFORE TEST:					SAND IN WELL BEFORE TEST:				
TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)						
DEPTH TO SAND IN WELL AFTER TEST:					SAND IN WELL AFTER TEST:					SAND IN WELL AFTER CLEANING:				
REMARKS:														

WES FORM 796  
MAR '53  
REVISED OCT '53

INSPECTOR

79.5

## Sand Infiltration Test

PROJECT: C.B. Level phase 2  
JOB LOCATION: C.B. I-77  
JOB #: \_\_\_\_\_  
CLIENT: \_\_\_\_\_

WELL #: 1022 6  
WELL DEPTH (ft): \_\_\_\_\_  
OPERATOR: \_\_\_\_\_  
INSPECTOR: \_\_\_\_\_  
DATE: 1-27-16

PUMP TEST START TIME: 1:05

[illegible]

\* Outlet valve should be calibrated to 0.5 GPM

Maximum Allowable sanding rate is 1pt / 25000 gal ~ 5ppm (parts per million)

If sanding rate exceeds specifications, describe measures taken between tests:

[illegible]





## Well #7 Pump Test Report

Static Water Level: 12.5

Pumping Rate: 70GPM

Date: 3/4/2016

### Well #7 (pumping Well)

MINUTES	DRAWDOWN	SANDTEST
5	6.1	
20	7.4	
45	7.4	30min. trace
60	6.4	trace

### Relief Well #6

MINUTES	DRAWDOWN
5	0.1
20	0.3
45	0.3
60	0.4

### Relief Well #8

MINUTES	DRAWDOWN
5	0.3
20	0.4
45	0.4
60	0.5



Griffin Dewatering Corporation  
6414 So. 84th Street  
Omaha, NE 68127  
(402) 331-5000

Date: 3/2/2016

Rig #: 3905

Contractor: Judd Bros.

Driller: Dave

Job Address: Council Bluffs Ia.

Helper: Clayton

Ameristar Casino

Branch: Omaha Ne.

Job #: \_\_\_\_\_

Depth of Hole 57'

Dia of borehole: 24"

Length of well: \_\_\_\_\_

Dia of well: 8"

Length of screen: 32' +5' bottom

Screen Type: SS

Well Yield: \_\_\_\_\_

Revert Used: 2 gal

Total Footage Drilled today: 60'

Water Table: 11'

No. of wells Installed today: 1

Delays - Explain: drilled into tree from 24' to 27'- 45 min

well # 7

### WELL LOG

Depth	Formation	Depth	Formation
0-2	top soil		
2'-10'	soft clay		
10-24'	fine silty sand		
24-27	tree and fine sand		
27-45	fine sand		
45- 50	coarse sand		
50-51	gray clay		
51-55	coarse sand		
55-56	gray clay		
56-60	very fine sand		

Dave

Driller

Verified Contractor

# RELIEF WELL PUMPING TEST REPORT

PROJECT: Tudds Bros. Relief wells LEVEE DISTRICT: Council Bluffs, IA  
 LOCATION (STA): Amenister ELEV TOP OF RISER: \_\_\_\_\_ WELL NO: # 07  
 DATE: 3-4-2016 TIME: 12:40 pm TEST STARTED: \_\_\_\_\_ TIME: 2:00 pm TEST COMPLETED: \_\_\_\_\_

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
12:40 pm	0	17.5 ft	<del>18.4 ft</del>	70					
12:45 pm	5	18.4	6.1 ft	70					
1:00 pm	20	19 ft	7.4 ft	70					
1:25 pm	45	19 ft	7.4 ft	70					
1:40 pm	60	19.4	6.4 ft	70					

## SAND INFILTRATION TEST

DEPTH OF WELL: \_\_\_\_\_ DEPTH TO SAND IN WELL BEFORE TEST: \_\_\_\_\_ SAND IN WELL BEFORE TEST: \_\_\_\_\_

TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST: \_\_\_\_\_ SAND IN WELL AFTER TEST: \_\_\_\_\_ SAND IN WELL AFTER CLEANING: \_\_\_\_\_

REMARKS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

WES FORM 796

MAR '53

REVISED OCT '53

INSPECTOR

# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Judds Bros. Relief wells</u>					LEVEE DISTRICT: <u>Council Bluffs, IA</u>				
LOCATION (STA): <u>Ameristar</u>				ELEV TOP OF RISER:			WELL NO. <u>11</u>		
DATE: <u>3-4-2016</u>				TIME TEST STARTED: <u>12:40 pm</u>			TIME TEST COMPLETED: <u>2:00 pm</u>		

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
<u>12:40 pm</u>	<u>0</u>	<u>11.8 ft</u>	<u>.1 ft</u>	<u>70</u>					
<u>12:45 pm</u>	<u>5</u>	<u>11.9 ft</u>	<u>.1 ft</u>	<u>70</u>					
<u>1:00 pm</u>	<u>20</u>	<u>12. ft</u>	<u>.3 ft</u>	<u>70</u>					
<u>1:25 pm</u>	<u>45</u>	<u>12. ft</u>	<u>.3 ft</u>	<u>70</u>					
<u>2:00 pm</u>	<u>60</u>	<u>12.1 ft</u>	<u>.4 ft</u>	<u>70</u>					

**SAND INFILTRATION TEST**

DEPTH OF WELL:				DEPTH TO SAND IN WELL BEFORE TEST:				SAND IN WELL BEFORE TEST:	
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TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED DUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST:				SAND IN WELL AFTER TEST:				SAND IN WELL AFTER CLEANING:	
REMARKS:									

WES FORM 796

MAR '53

REVISED OCT '53

INSPECTOR

# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Judds Bros. Relief wells</u>					LEVEE DISTRICT: <u>Council Bluffs, IA</u>				
LOCATION (STA): <u>Ameristar</u>				ELEV TOP OF RISER:			WELL NO: <u>#8</u>		
DATE: <u>3-4-2016</u>				TIME <u>12:40 pm</u>			TIME <u>2:50 pm</u>		
				TEST STARTED:			TEST COMPLETED:		
TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
<u>12:40 pm</u>	<u>0</u>	<u>13.3 ft</u>	<u>.3 ft</u>	<u>70</u>					
<u>12:45 pm</u>	<u>5</u>	<u>13.6 ft</u>	<u>.3 ft</u>	<u>70</u>					
<u>1:00 pm</u>	<u>20</u>	<u>13.7 ft</u>	<u>.4 ft</u>	<u>70</u>					
<u>1:25 pm</u>	<u>45</u>	<u>13.7 ft</u>	<u>.4 ft</u>	<u>70</u>					
<u>2:40 pm</u>	<u>60</u>	<u>13.8 ft</u>	<u>.5 ft</u>	<u>70</u>					
SAND INFILTRATION TEST									
DEPTH OF WELL:				DEPTH TO SAND IN WELL BEFORE TEST:			SAND IN WELL BEFORE TEST:		
TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)	
DEPTH TO SAND IN WELL AFTER TEST:				SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:		
REMARKS:									

WES FORM 796  
MAR '53  
REVISED OCT '53

INSPECTOR

## Sand Infiltration Test

PROJECT: Judds Relief Wells  
JOB LOCATION: Canal Bluffs, IA  
JOB #: 001251  
CLIENT: Judds / City of CB

WELL #: 7  
WELL DEPTH (ft): 57 ft  
OPERATOR: \_\_\_\_\_  
INSPECTOR: \_\_\_\_\_  
DATE: 3/4/16

PUMP TEST START TIME: 12:10

[illegible]

\* Outlet valve should be calibrated to 0.5 GPM

Maximum Allowable sanding rate is 1pt / 25000 gal ~ 5ppm (parts per million)

If sanding rate exceeds specifications, describe measures taken between tests:

[illegible]



## Well #8 Pump Test Report

Static Water Level: 13.2

Pumping Rate: 70GPM

Date: 3/4/2016

### Well #8 (pumping Well)

MINUTES	DRAWDOWN	SANDTEST
5	1.2	
20	6.5	
45	6.3	30min. trace
60	6.5	trace

### Relief Well #7

MINUTES	DRAWDOWN
5	0.2
20	0.4
45	2.9
60	2.9

### Relief Well #6

MINUTES	DRAWDOWN
5	0.2
20	0.2
45	2.7
60	2.8



Griffin Dewatering Corporation  
6414 So. 84th Street  
Omaha, NE 68127  
(402) 331-5000

Date: 3/3/2016

Rig #: 3905

Contractor Judd Bros.

Driller: Clayton

Job Address: Council Bluffs Ia.

Helper: Brian Justin Nick

Ameristar Casino

Branch: Omaha Ne.

Job #:

Depth of Hole 60

Dia of borehole: 24"

Length of well: 57'

Dia of well: 8"

Length of screen: 37' +5' blank bottom

Screen Type: 55

Well Yield:

Revert Used: 2 gal

Total Footage Drilled today: 60

Water Table: 11'

No. of wells installed today: 1

Delays - Explain:

Well #48

### WELL LOG

Depth	Formation	Depth	Formation
0-2	top soil		
2'-10	clay		
10'-25'	silty fine sand		
25-45	medium clean sand		
45-50	medium to coarse sand		
50-51	soft clay		
55-56	medium sand just a trace coarse		
56-60	very fine sand		

Clayton

Driller

Dave Lane

Superintendent



# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Judds Bros. Relief wells</u>		LEVEE DISTRICT: <u>Council Bluffs, IA</u>	
LOCATION (STA): <u>Amenistar</u>		ELEV TOP OF RISER:	WELL NO: <u>#8</u>

DATE: <u>3-4-2016</u>	TIME TEST STARTED: <u>10:20 am</u>	TIME TEST COMPLETED: <u>11:30 am</u>
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TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
10:20	0	13.2	12.4	70					
10:25	5	14.4	12.4	70					
10:40	20	27.7	6.5	70					
11:00	45	17.5	6.3	70					
11:20	60	11.7	6.5	70					

## SAND INFILTRATION TEST

DEPTH OF WELL:	DEPTH TO SAND IN WELL BEFORE TEST:	SAND IN WELL BEFORE TEST:
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TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST:	SAND IN WELL AFTER TEST:	SAND IN WELL AFTER CLEANING:
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REMARKS:

# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Tudds Bros. Relief wells</u>					LEVEE DISTRICT: <u>Council Bluffs, IA</u>				
LOCATION (STA): <u>Ameristar</u>				ELEV TOP OF RISER:			WELL NO. <u># 7</u>		
DATE: <u>3-4-2016</u>				TIME <u>10:20</u> TEST STARTED:			TIME <u>11:30 AM</u> TEST COMPLETED:		
TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
<u>10:20 AM</u>	<u>0</u>	<u>10.1 ft</u>	<u>10.2 ft</u>	<u>70</u>					
<u>10:25 AM</u>	<u>5</u>	<u>10.2 ft</u>	<u>10.2 ft</u>	<u>70</u>					
<u>10:40 AM</u>	<u>20</u>	<u>10.4 ft</u>	<u>10.4 ft</u>	<u>70</u>					
<u>11:00 AM</u>	<u>45</u>	<u>12.9 ft</u>	<u>2.5 ft</u>	<u>70</u>					
<u>11:20 AM</u>	<u>60</u>	<u>12.9 ft</u>	<u>2.5 ft</u>	<u>70</u>					
SAND INFILTRATION TEST									
DEPTH OF WELL:				DEPTH TO SAND IN WELL BEFORE TEST:			SAND IN WELL BEFORE TEST:		
TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)	
DEPTH TO SAND IN WELL AFTER TEST:				SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:		
REMARKS:									

# RELIEF WELL PUMPING TEST REPORT

PROJECT: <u>Judds Bros. Relief wells</u>					LEVEE DISTRICT: <u>Council Bluffs, IA</u>				
LOCATION (STA): <u>Amenistar</u>				ELEV TOP OF RISER:			WELL NO: <u>#6</u>		
DATE: <u>3-4-2016</u>				TIME <u>10:20</u> TEST STARTED:			TIME <u>11:30 am</u> TEST COMPLETED:		

TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM	TIME	ELAPSED TIME MINUTES	DEPTH TO WATER	DRAWDOWN IN FEET	FLOW IN GPM
<u>10:20 AM</u>	<u>0</u>	<u>10.1 ft</u>	<u>10.1 ft</u>	<u>70</u>					
<u>10:25 AM</u>	<u>5</u>	<u>10.2 ft</u>	<u>10.2 ft</u>	<u>70</u>					
<u>10:40 AM</u>	<u>20</u>	<u>10.2 ft</u>	<u>10.2 ft</u>	<u>70</u>					
<u>11:00 AM</u>	<u>45</u>	<u>12.8 ft</u>	<u>2.6 ft</u>	<u>70</u>					
<u>11:20 AM</u>	<u>60</u>	<u>12.9 ft</u>	<u>2.7 ft</u>	<u>70</u>					

SAND INFILTRATION TEST

DEPTH OF WELL:			DEPTH TO SAND IN WELL BEFORE TEST:			SAND IN WELL BEFORE TEST:		
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TEST NO.	TIME	DEPTH TO SAND (FT)	SAND IN WELL (PTS)	GAIN OR LOST OF SAND IN WELL (PTS)	SAND PUMPED OUT OF WELL (PTS)	TOTAL INFLOW OF SAND INTO WELL (PTS)	LENGTH OF TEST (MIN)	RATE OF SAND INFILTRATION (PTS. HR)

DEPTH TO SAND IN WELL AFTER TEST:			SAND IN WELL AFTER TEST:			SAND IN WELL AFTER CLEANING:		
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REMARKS:

WES FORM 796  
MAR '53  
REVISED OCT '53

INSPECTOR

3' deep  
8000 sq ft.

lok

## Sand Infiltration Test

PROJECT: Judds Relief Wells  
JOB LOCATION: Council Bluffs, IA  
JOB #: 001251  
CLIENT: Judds / City of CB

WELL #: 59A  
WELL DEPTH (ft): 59 ft  
OPERATOR: \_\_\_\_\_  
INSPECTOR: \_\_\_\_\_  
DATE: 3/4/16

PUMP TEST START TIME: 10:20

[illegible]

\* Outlet valve should be calibrated to 0.5 GPM

Maximum Allowable sanding rate is 1pt / 25000 gal ~ 5ppm (parts per million)

If sanding rate exceeds specifications, describe measures taken between tests:

[illegible]

Industrial Park Levee- Council Bluffs, Iowa

Pilot Hole Logs and Obs. Well Slug Test Results



WATER LEVEL OBSERVATIONS		PROJECT					DRILLER	LOGGER		JOB NO.		DATE		
During Drilling		10'	Relief Well Pilot Holes – Industrial Park Levee					Gappa	Yakel		15756.00		12/29/15	
End of Drilling			LOCATION					DRILLING METHOD			DRILL RIG		BORING NO.	
			River Road, Council Bluffs, IA					3.25" HSA			CME 750		PH-1	
			LOCATION OF BORING					TYPE OF SURFACE			ELEVATION		DEPTH	
installed well TH-1 to 40 feet			see Boring Location Plan					grass			977'		60'	
DEP (ft.)	VISUAL/MANUAL DESCRIPTION						SAMPLE DATA			LABORATORY DATA				DEP (ft.)
	COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	NO. & TYPE	SPT (bpf)	REC (in.)	MC (%)	γ <sub>d</sub> (pcf)	q <sub>u</sub> (tsf)	LL/PI CLASS	
5	grayish brown	moist	very loose	silty sand	fill	trace gravel								
						S-1	2							
						S-2	3							
10	brown	very moist	loose	silty sand	alluvium	iron and carbon staining	S-3	5		30.2			P200 40.1% SM	10
		wet	medium dense	poorly graded sand with silt		S-4	21		23.1			P200 5.4% SP-SM	15	
			loose	poorly graded sand		S-5	10							20
				loose		trace silt	S-6	9		17.4			P200 2.3% SP	25



WATER LEVEL OBSERVATIONS		PROJECT			DRILLER	LOGGER	JOB NO.		DATE					
During Drilling	10'	Relief Well Pilot Holes – Industrial Park Levee			Gappa	Yakel	15756.00		12/29/15					
End of Drilling		LOCATION			DRILLING METHOD		DRILL RIG		BORING NO.					
		River Road, Council Bluffs, IA			3.25" HSA		CME 750		PH-1 (cont.)					
		LOCATION OF BORING			TYPE OF SURFACE		ELEVATION		DEPTH					
installed well TH-1 to 40 feet		see Boring Location Plan			grass		977'		60'					
DEP (ft.)	VISUAL/MANUAL DESCRIPTION						SAMPLE DATA			LABORATORY DATA				DEP (ft.)
	COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	NO. & TYPE	SPT (bpf)	REC (in.)	MC (%)	γ <sub>d</sub> (pcf)	q <sub>u</sub> (tsf)	LL/PI CLASS	
30	brown	wet	loose	poorly graded sand	alluvium									
	gray		very loose	silty sand			S-7	1		30.5			P200 14.1% SM	30
35														
			medium dense	poorly graded sand with silt			S-8	20		19.4			P200 6.6% SP-SM	35
40														
							S-9	15		23.8			P200 5.5% SP-SM	40
45														
			dense				S-10	38		24.4			P200 10.8% SP-SM	45
50														
			medium dense				S-11	24						50

[illegible]





WATER LEVEL OBSERVATIONS		PROJECT		DRILLER	LOGGER	JOB NO.	DATE								
During Drilling		8.5'	Relief Well Pilot Holes – Industrial Park Levee		Morrisey	Yakel	15756.00	12/18/15							
End of Drilling		9.6'	LOCATION		DRILLING METHOD		DRILL RIG	BORING NO.							
Cave-in		9.6'	River Road, Council Bluffs, IA		3.25" HSA		CME 55	PH-2							
			LOCATION OF BORING		TYPE OF SURFACE		ELEVATION	DEPTH							
installed well TH-2 to 40 feet			see Boring Location Plan		grass		977'	60'							
DEP (ft.)	VISUAL/MANUAL DESCRIPTION						SAMPLE DATA			LABORATORY DATA				DEP (ft.)	
	COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	NO. & TYPE	SPT (bpf)	REC (in.)	MC (%)	γ <sub>d</sub> (pcf)	q <sub>u</sub> (tsf)	LL/PI CLASS		
5	light yellowish brown	moist	loose	silty sand	fill	trace fine gravel  large piece of wood									
							U-1		6						
							S-2	5							
	light brown	loose	fat clay poorly graded sand with silt												
													S-3	4	
10	brown	wet	medium dense	poorly graded sand with silt	alluvium	trace silt	S-4	12		21.8				P200 7.1% SP-SM	10
			loose												
														S-5	7
			medium dense	poorly graded sand											
															S-6
25	light gray		loose												
														S-7	9

[illegible]

[illegible]

[illegible]



WATER LEVEL OBSERVATIONS		PROJECT					DRILLER	LOGGER		JOB NO.		DATE		
During Drilling		12.5'	Relief Well Pilot Holes – Industrial Park Levee					Morrisey	Kendle		15756.00		12/29/15	
End of Drilling		11.1'	LOCATION					DRILLING METHOD			DRILL RIG		BORING NO.	
Cave-in		14.1'	River Road, Council Bluffs, IA					3.25" HSA			CME 55		PH-3(cont.)	
			LOCATION OF BORING					TYPE OF SURFACE			ELEVATION		DEPTH	
installed well TH-3 to 40 feet			see Boring Location Plan					grass			977'		60'	
DEP (ft.)	VISUAL/MANUAL DESCRIPTION						SAMPLE DATA			LABORATORY DATA				DEP (ft.)
	COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	NO. & TYPE	SPT (bpf)	REC (in.)	MC (%)	γ <sub>d</sub> (pcf)	q <sub>u</sub> (tsf)	LL/PI CLASS	
30	gray	wet	loose	poorly graded sand with silt	alluvium	trace silt								
			medium dense	poorly graded sand			S-7	19		19.2			P200 3.2% SP	
35				poorly graded sand with silt		S-8	23		23.2			P200 7.4% SP-SM	35	
40						S-9	16		21.6			P200 5.9% SP-SM	40	
45			dense			S-10	33		23.7			P200 10.3% SP-SM	45	
50			medium dense			S-11	18		23.0			P200 8.4% SP-SM	50	

[illegible]



WATER LEVEL OBSERVATIONS		PROJECT					DRILLER	LOGGER		JOB NO.		DATE									
During Drilling		13.5'	Relief Well Pilot Holes – Industrial Park Levee					Morrisey	Kendle		15756.00		12/30/15								
End of Drilling		14.0'	LOCATION					DRILLING METHOD			DRILL RIG		BORING NO.								
Cave-in		19.2'	River Road, Council Bluffs, IA					3.25" HSA			CME 55		PH-4								
			LOCATION OF BORING					TYPE OF SURFACE			ELEVATION		DEPTH								
installed well TH-4 to 39 feet			see Boring Location Plan					grass			978'		60'								
DEP (ft.)	VISUAL/MANUAL DESCRIPTION						SAMPLE DATA			LABORATORY DATA				DEP (ft.)							
	COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	NO. & TYPE	SPT (bpf)	REC (in.)	MC (%)	γ <sub>d</sub> (pcf)	q <sub>u</sub> (tsf)	LL/PI CLASS								
5	light grayish brown	moist	firm	lean clay	fill	roots minor gravel iron and carbon stains															
						U-1		11													
	gray					much silt trace gravel iron and carbon stains															
						U-2		12	23.1	101.9		LL=35 PI=10 ML									
10	grayish brown	moist	loose	silty sand	alluvium		U-4		8												
		wet					S-5	6		29.3			P200 13.8% SM								
20	gray			poorly graded sand with silt			S-6	8													
25			medium dense				S-7	13		25.3			P200 5.0% SP-SM								



WATER LEVEL OBSERVATIONS		PROJECT					DRILLER	LOGGER		JOB NO.		DATE			
During Drilling		13.5'		Relief Well Pilot Holes – Industrial Park Levee					Morrisey	Kendle		15756.00		12/30/15	
End of Drilling		14.0'		LOCATION					DRILLING METHOD			DRILL RIG		BORING NO.	
Cave-in		19.2'		River Road, Council Bluffs, IA					3.25" HSA			CME 55		PH-4(cont.)	
				LOCATION OF BORING					TYPE OF SURFACE			ELEVATION		DEPTH	
installed well TH-4 to 39 feet				see Boring Location Plan					grass			978'		60'	
DEP (ft.)	VISUAL/MANUAL DESCRIPTION						SAMPLE DATA			LABORATORY DATA				DEP (ft.)	
	COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	NO. & TYPE	SPT (bpf)	REC (in.)	MC (%)	γ <sub>d</sub> (pcf)	q <sub>u</sub> (tsf)	LL/PI CLASS		
30	gray	wet	medium dense	poorly graded sand with silt	alluvium										
							S-8	9		24.7			P200 5.3% SP-SM	30	
							S-9	18		23.5			P200 5.4% SP-SM	35	
35															
							S-10	14		22.9			P200 2.7% SP	40	
40				poorly graded sand		trace silt									
							S-11	10		15.6			P200 7.2% SW-SM	45	
45				well graded sand with silt											
							S-12	10		15.1			P200 4.2% SP	50	
50				poorly graded sand		trace clay and silt 2" clay lens @49.8'									



[illegible]



WATER LEVEL OBSERVATIONS		PROJECT				DRILLER	LOGGER		JOB NO.		DATE				
During Drilling		8.5'		Relief Well Pilot Holes – Industrial Park Levee				Gappa		Yakel		15756.00		12/30/15	
End of Drilling		10.5'		LOCATION				DRILLING METHOD			DRILL RIG		BORING NO.		
Cave-in		10.5'		River Road, Council Bluffs, IA				3.25" HSA			CME 750		PH-5		
				LOCATION OF BORING				TYPE OF SURFACE			ELEVATION		DEPTH		
installed well TH-5 to 40 feet				see Boring Location Plan				grass			977.5'		60'		
DEP (ft.)	VISUAL/MANUAL DESCRIPTION						SAMPLE DATA			LABORATORY DATA				DEP (ft.)	
	COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	NO. & TYPE	SPT (bpf)	REC (in.)	MC (%)	γ <sub>d</sub> (pcf)	q <sub>u</sub> (tsf)	LL/PI CLASS		
5	brown	moist	firm	lean clay	fill	minor silt trace gravel									
						U-1		11							
	gray	moist	medium	silty sand	alluvium	appreciable silt									
						U-2		11							
10	gray	very moist		poorly graded sand		trace silt									
						U-3		8	23.2			P200 4.5% SP			
	light brownish gray	wet		poorly graded sand with silt											
						S-4	11		29.2			P200 10.7% SP-SM	10		
15	gray		loose	silty sand											
						S-5	6								
20	gray														
						S-6	7		28.0			P200 16.8% SM	20		
25															
						S-7	12							25	



WATER LEVEL OBSERVATIONS		PROJECT					DRILLER	LOGGER		JOB NO.		DATE							
During Drilling		8.5'	Relief Well Pilot Holes – Industrial Park Levee					Gappa	Yakel		15756.00		12/30/15						
End of Drilling		10.5'	LOCATION					DRILLING METHOD			DRILL RIG		BORING NO.						
Cave-in		10.5'	River Road, Council Bluffs, IA					3.25" HSA			CME 750		PH-5(cont.)						
			LOCATION OF BORING					TYPE OF SURFACE			ELEVATION		DEPTH						
installed well TH-5 to 40 feet			see Boring Location Plan					grass			977.5'		60'						
DEP (ft.)	VISUAL/MANUAL DESCRIPTION						SAMPLE DATA			LABORATORY DATA				DEP (ft.)					
	COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	NO. & TYPE	SPT (bpf)	REC (in.)	MC (%)	γ <sub>d</sub> (pcf)	q <sub>u</sub> (tsf)	LL/PI CLASS						
30	gray	wet	medium dense	poorly graded sand with silt	alluvium														
							S-8	10		20.2			P200 5.0% SP-SM	30					
S-9							14		22.2			P200 7.8% SP-SM	35						
S-10							19		21.5			P200 6.3% SP-SM	40						
S-11							13		21.9			P200 8.4% SP-SM	45						
S-12							19												
50																			50

[illegible]

[illegible]



Job No.	15756.00
Date	1/5/2016

[illegible]



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-1 S-3

Sample Description:

brown silty sand

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

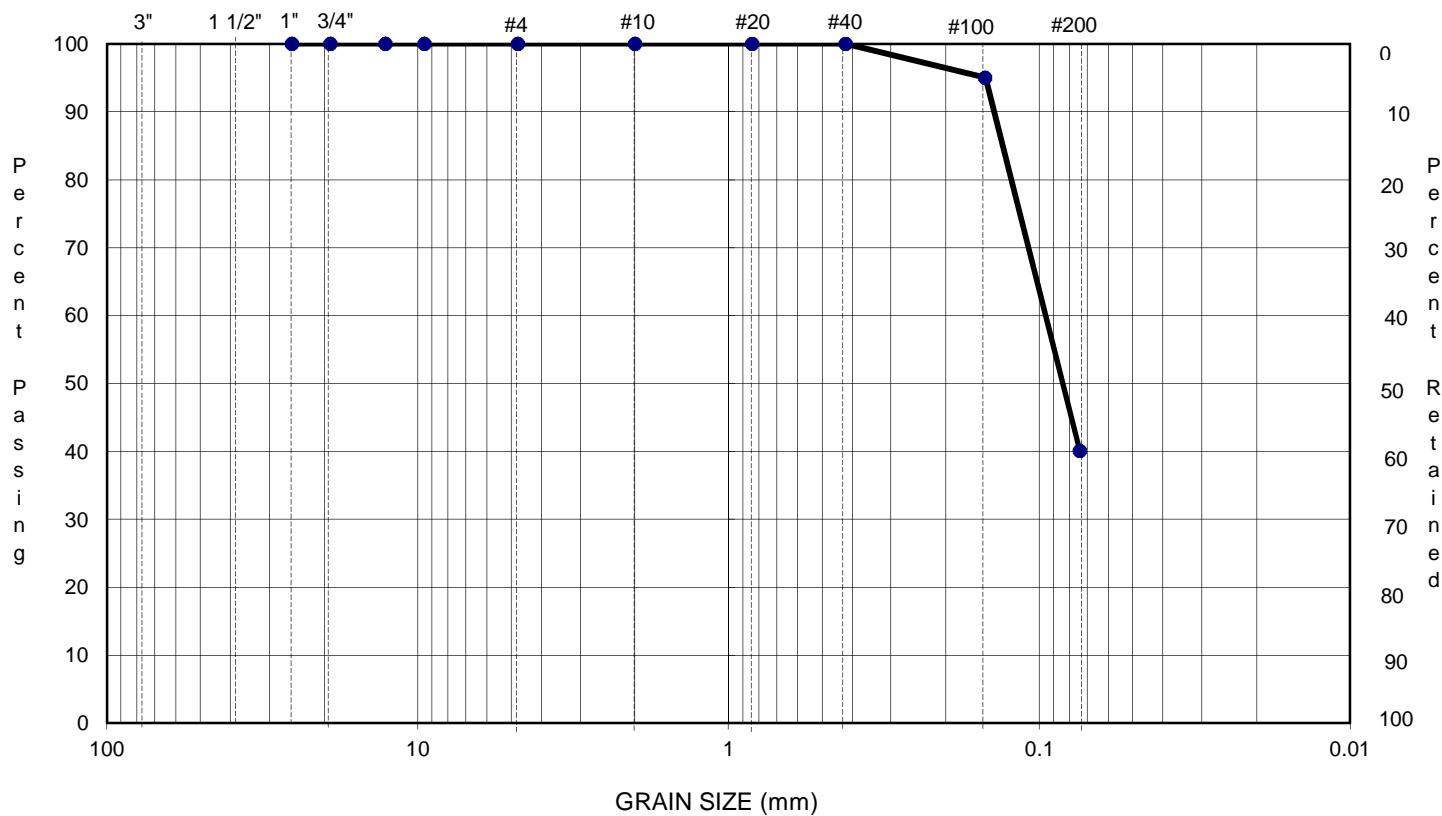
# 10	100
------	-----

# 20	100
------	-----

# 40	100
------	-----

# 100	95
-------	----

# 200	40
-------	----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-1 S-4

Sample Description:

brown sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

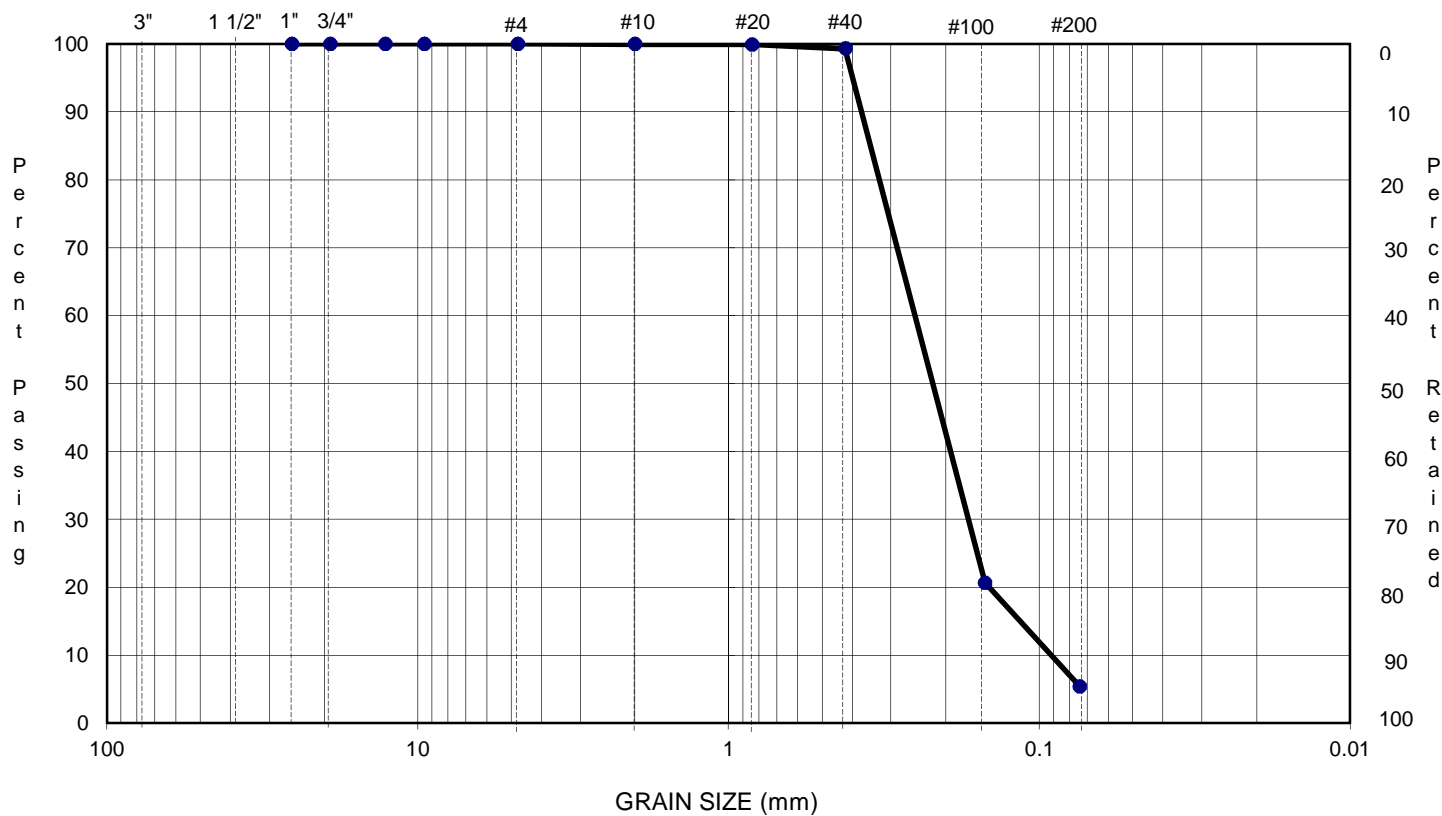
# 10	100
------	-----

# 20	100
------	-----

# 40	99
------	----

# 100	21
-------	----

# 200	5.4
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_





Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-1 S-6

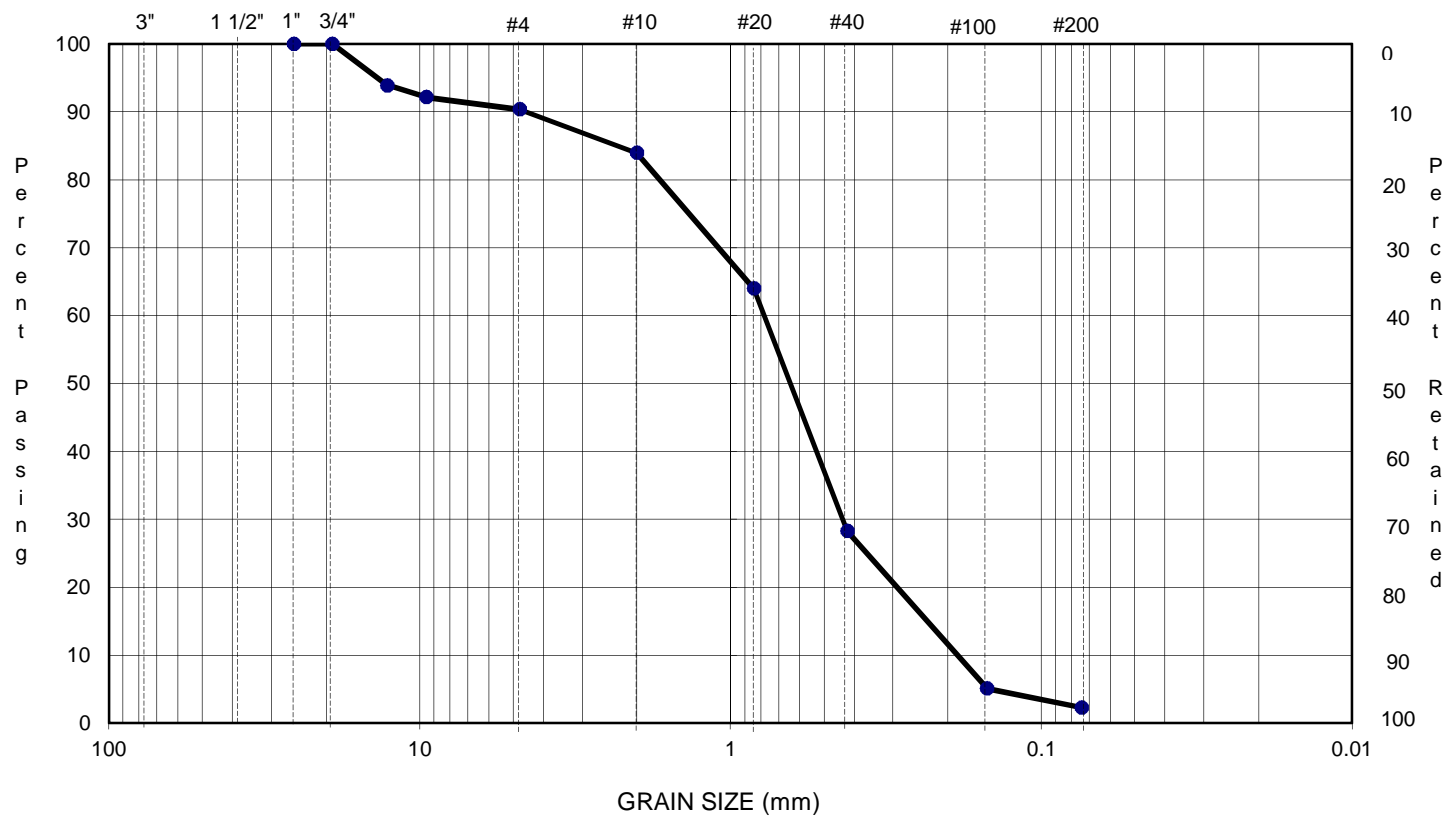
Sample Description:

brown sand

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	100
1/2"	94
3/8"	92
# 4	90
# 10	84
# 20	64
# 40	28
# 100	5.1
# 200	2.3



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-1 S-7

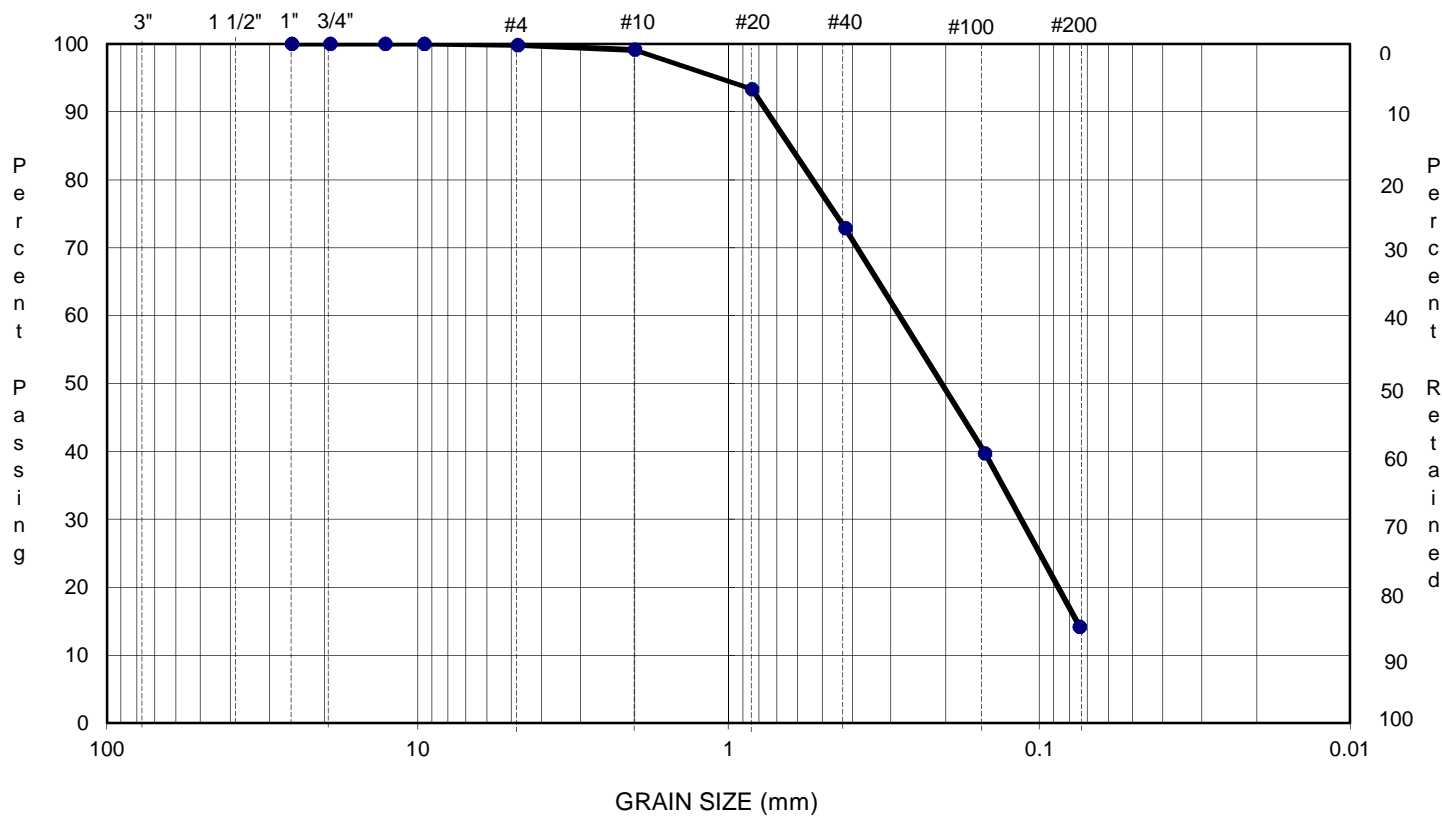
Sample Description:

gray silty sand

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	99
# 20	93
# 40	73
# 100	40
# 200	14



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-1 S-8

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	98
-----	----

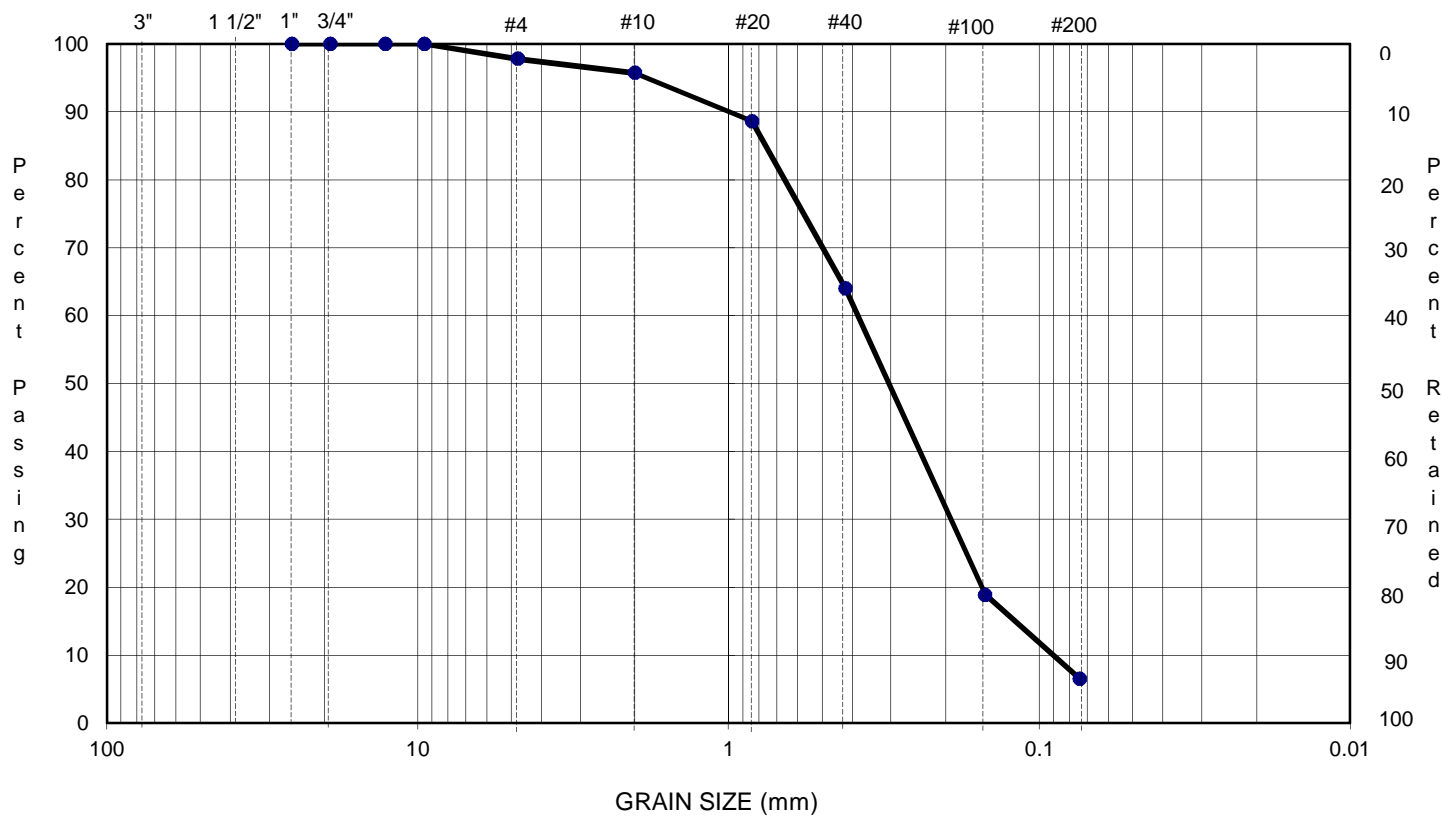
# 10	96
------	----

# 20	89
------	----

# 40	64
------	----

# 100	19
-------	----

# 200	6.6
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## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-1 S-9

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

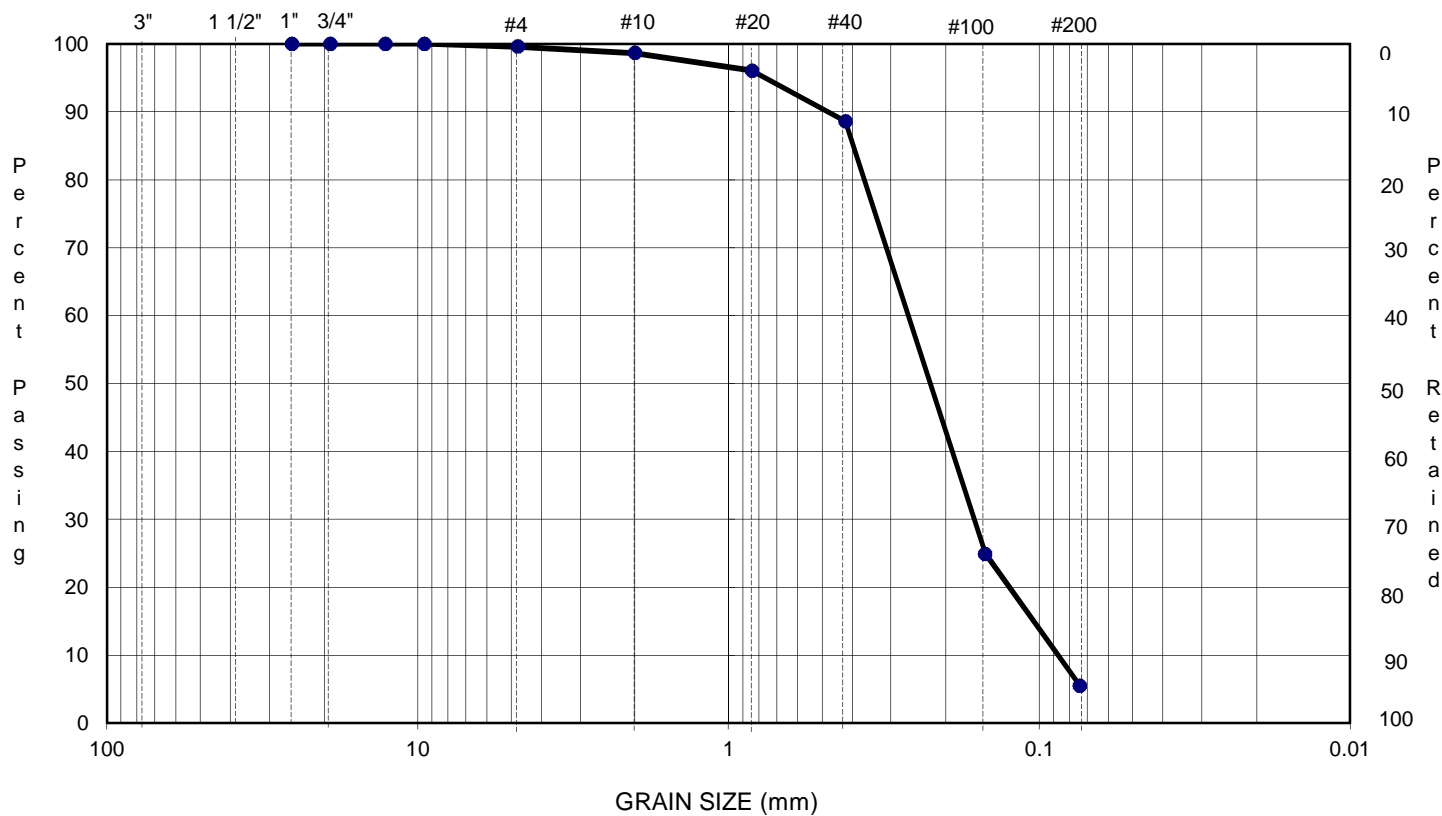
# 10	99
------	----

# 20	96
------	----

# 40	89
------	----

# 100	25
-------	----

# 200	5.5
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-1 S-10

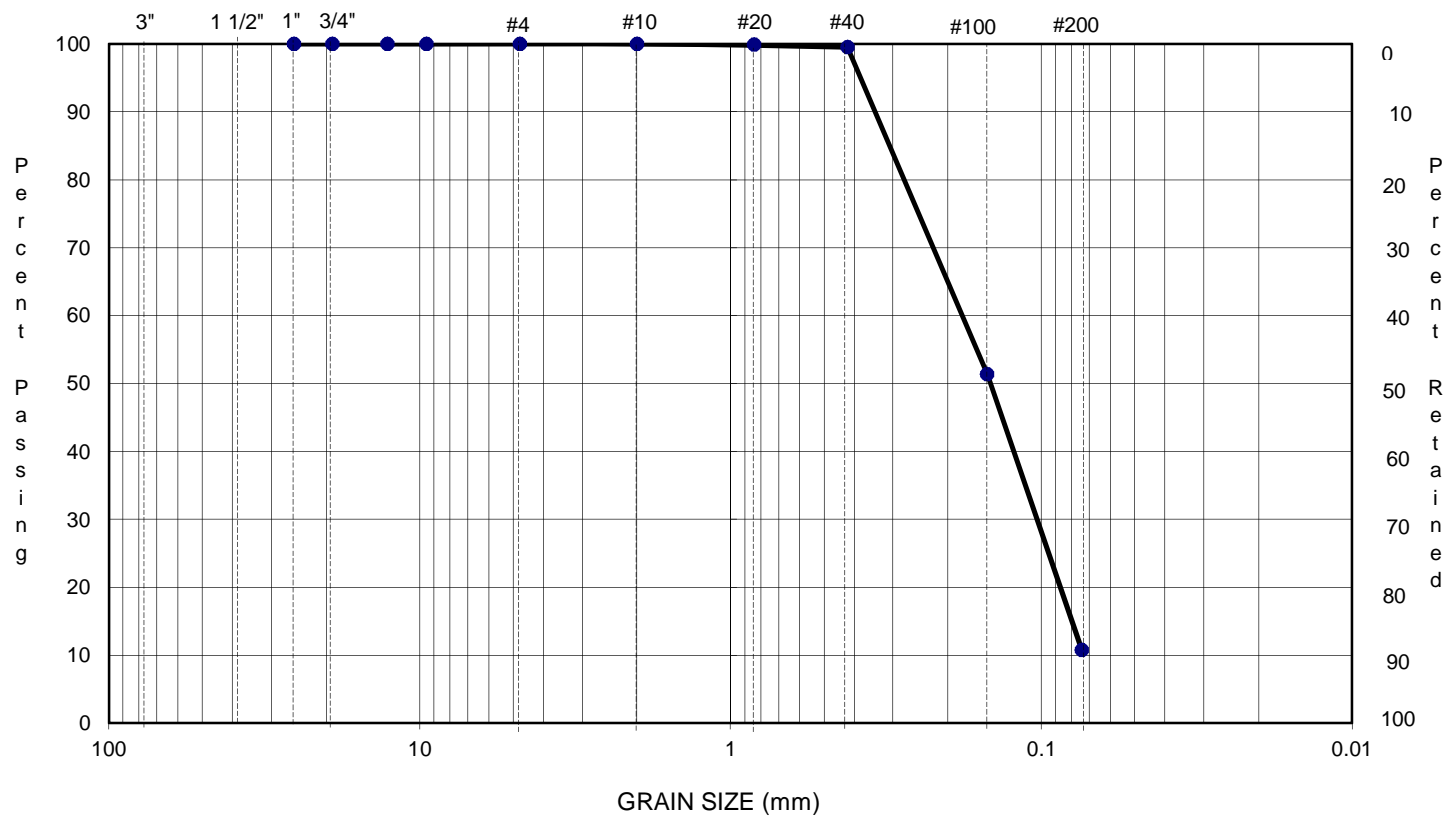
Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	100
# 40	100
# 100	51
# 200	11



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-1 S-12

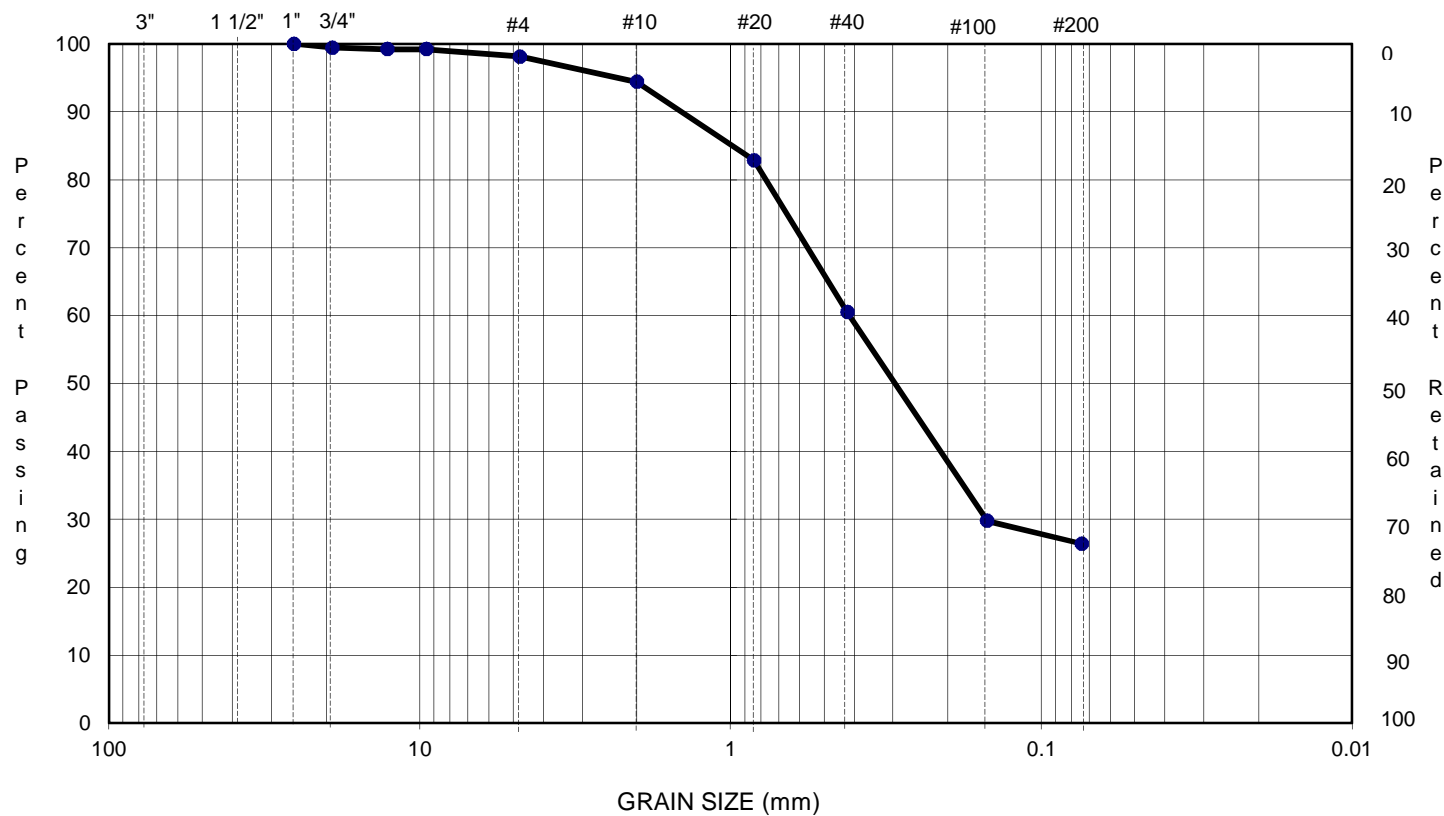
Sample Description:

gray silty sand

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	99
1/2"	99
3/8"	99
# 4	98
# 10	94
# 20	83
# 40	60
# 100	30
# 200	26



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

12/28/15

Sample Identification:

PH-2 S-4

Sample Description:

brown sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

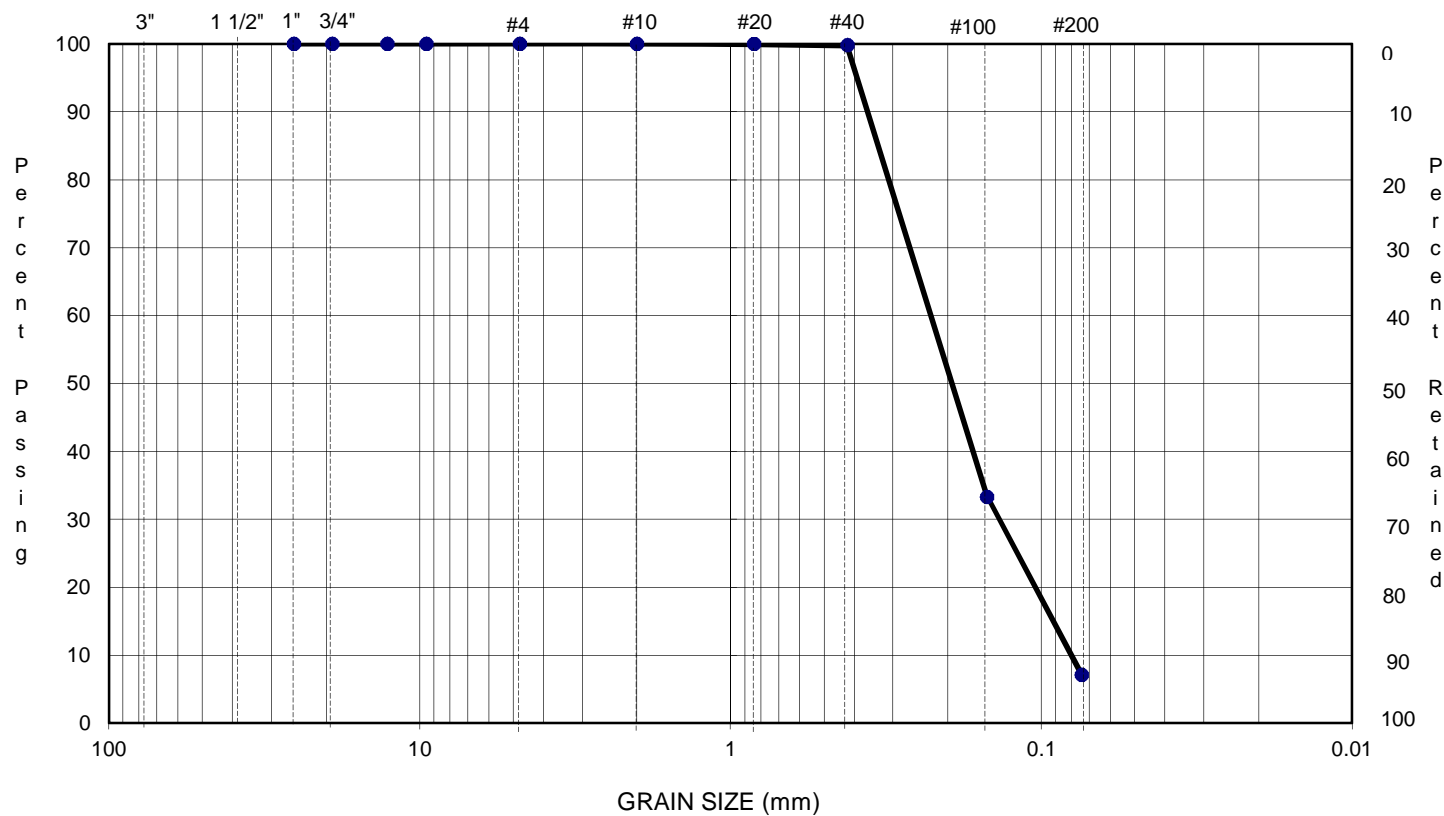
# 10	100
------	-----

# 20	100
------	-----

# 40	100
------	-----

# 100	33
-------	----

# 200	7.1
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

12/28/15

Sample Identification:

PH-2 S-6

Sample Description:

brown sand

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	99
------	----

# 4	98
-----	----

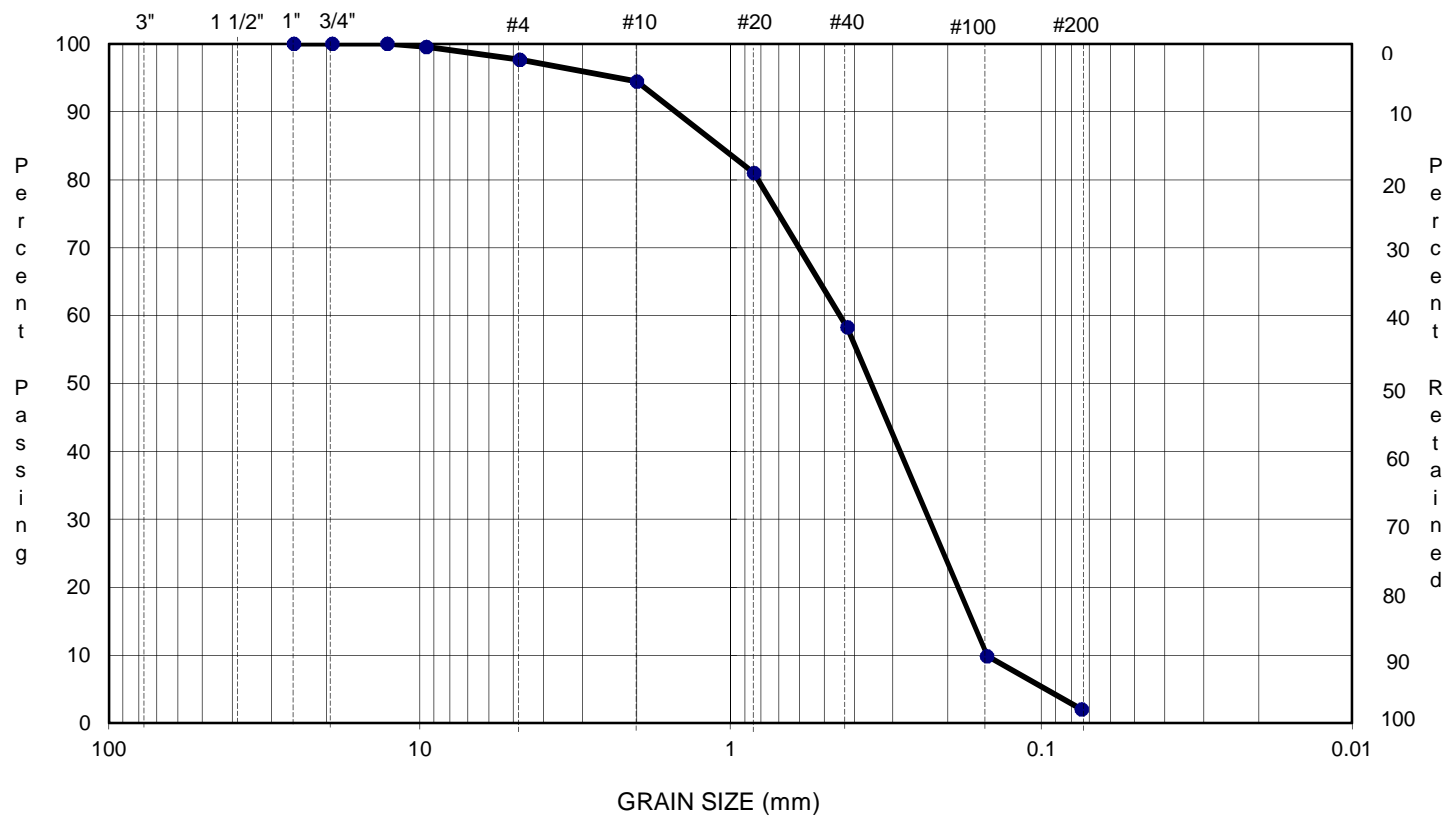
# 10	94
------	----

# 20	81
------	----

# 40	58
------	----

# 100	10
-------	----

# 200	2.0
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_





Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

12/28/15

Sample Identification:

PH-2 S-8

Sample Description:

light gray sand

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

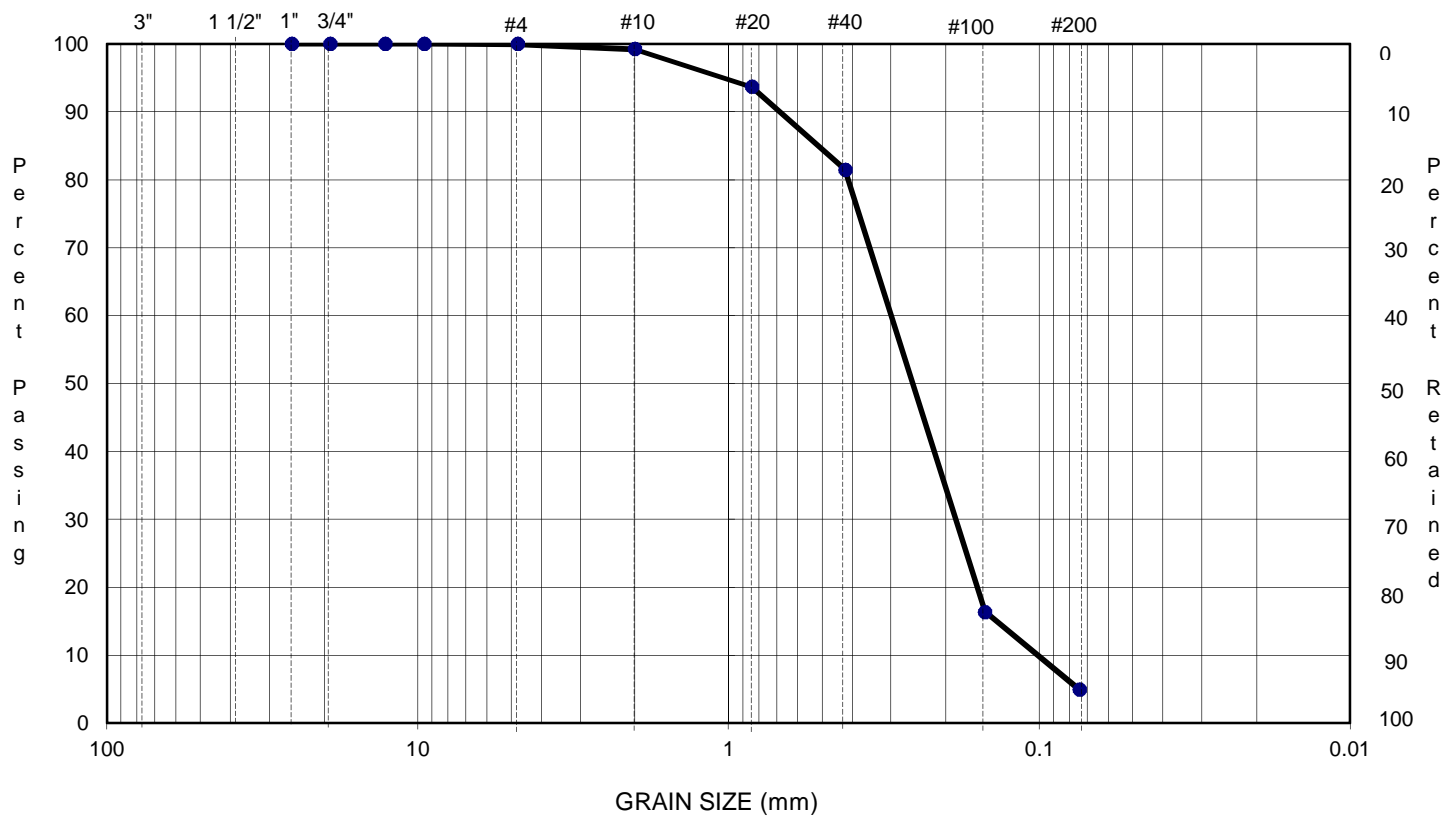
# 10	99
------	----

# 20	94
------	----

# 40	81
------	----

# 100	16
-------	----

# 200	4.9
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

12/28/15

Sample Identification:

PH-2 S-9

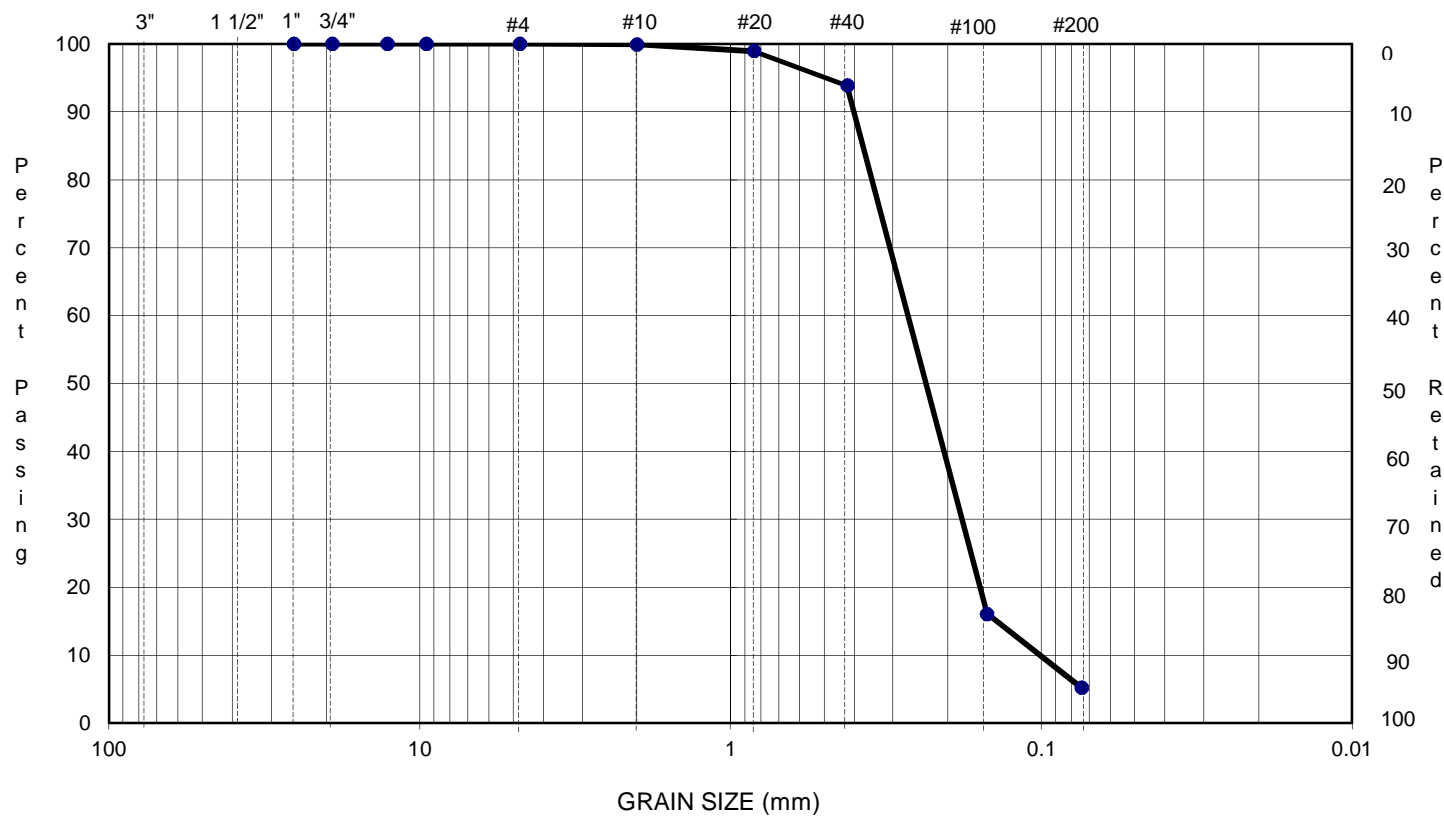
Sample Description:

light gray sand with silt

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	99
# 40	94
# 100	16
# 200	5.2



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

12/28/15

Sample Identification:

PH-2 S-10

Sample Description:

light gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

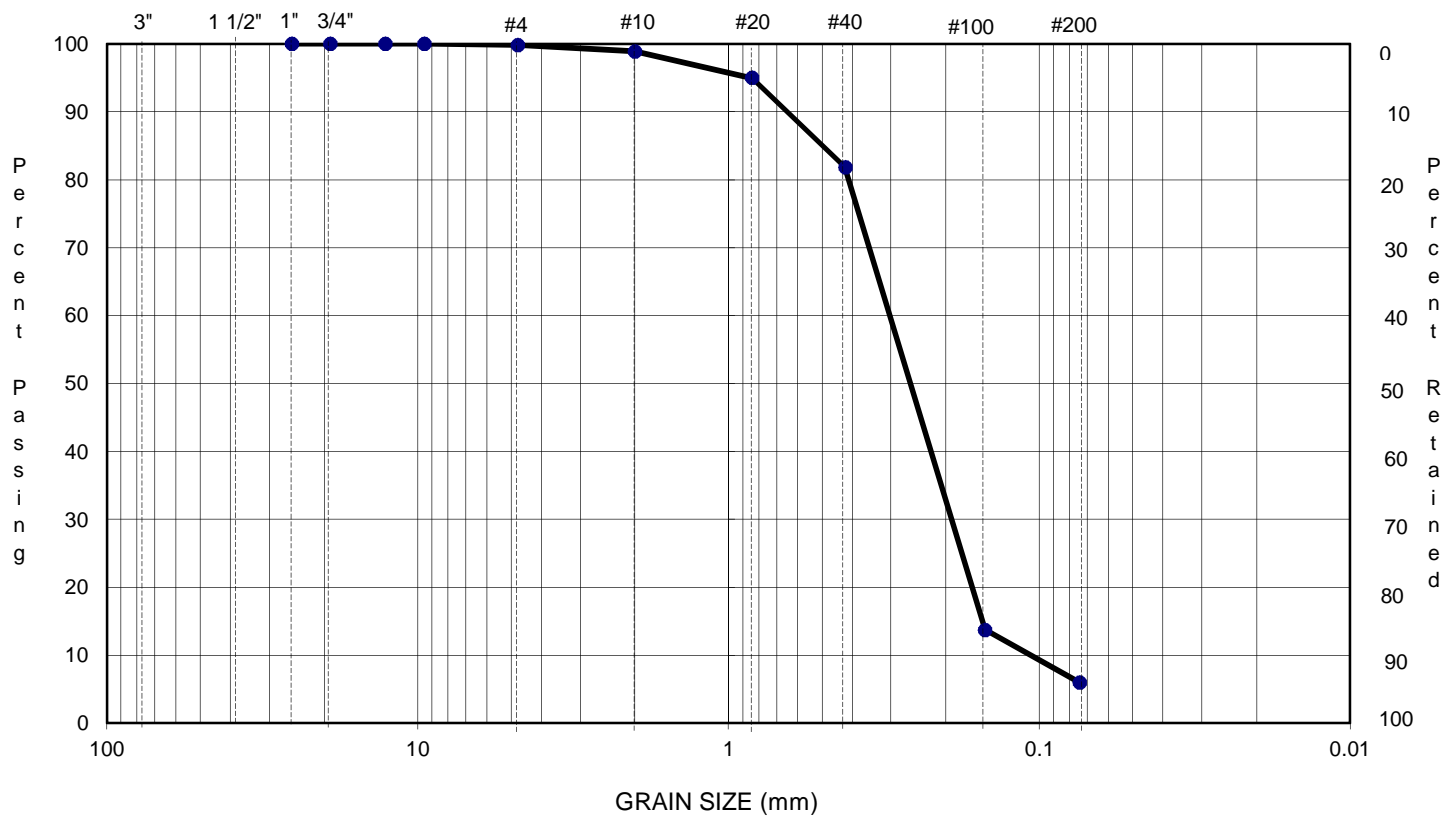
# 10	99
------	----

# 20	95
------	----

# 40	82
------	----

# 100	14
-------	----

# 200	6.0
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

12/28/15

Sample Identification:

PH-2 S-11

Sample Description:

light gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

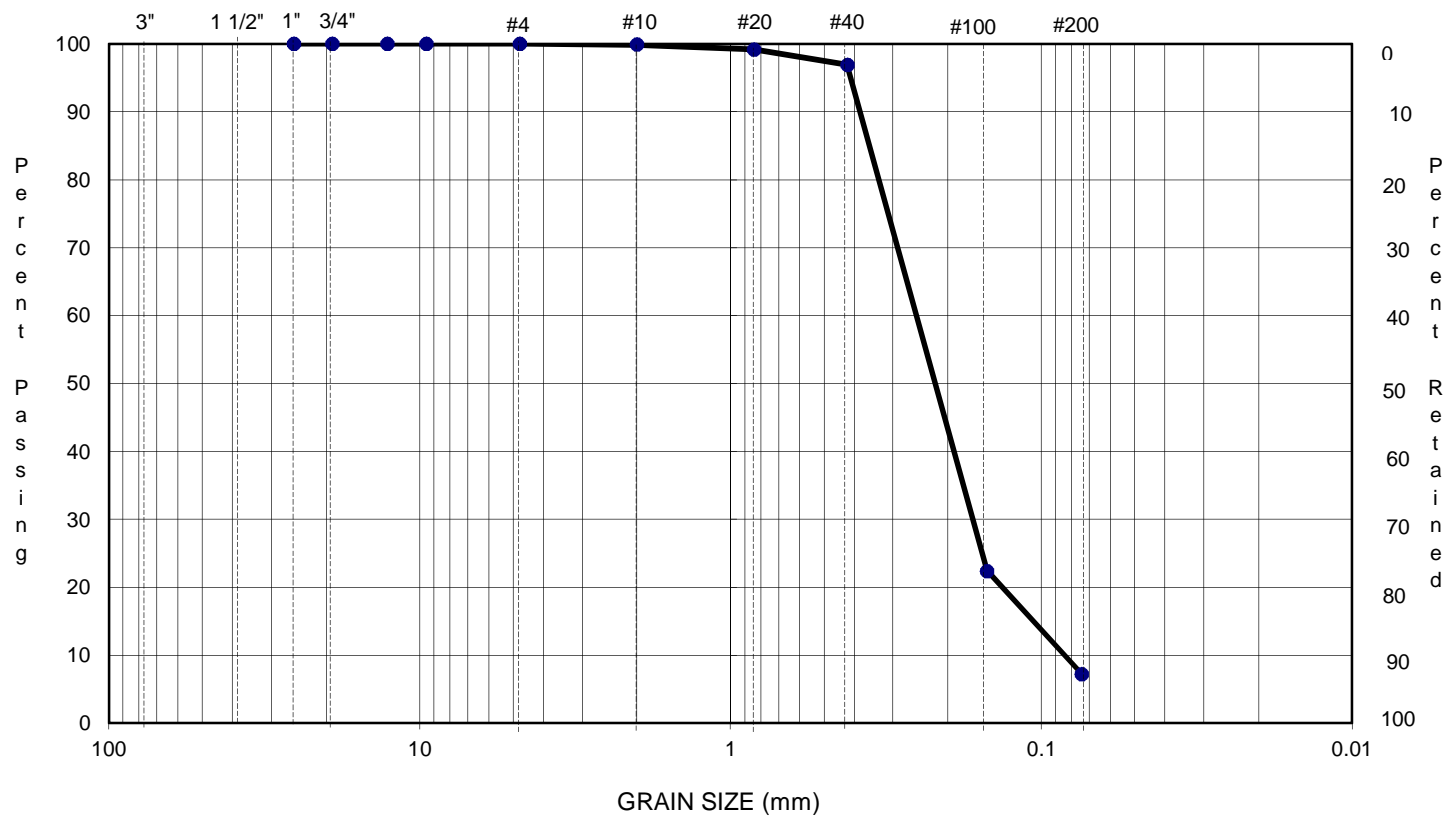
# 10	100
------	-----

# 20	99
------	----

# 40	97
------	----

# 100	22
-------	----

# 200	7.2
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

12/28/15

Sample Identification:

PH-2 S-12

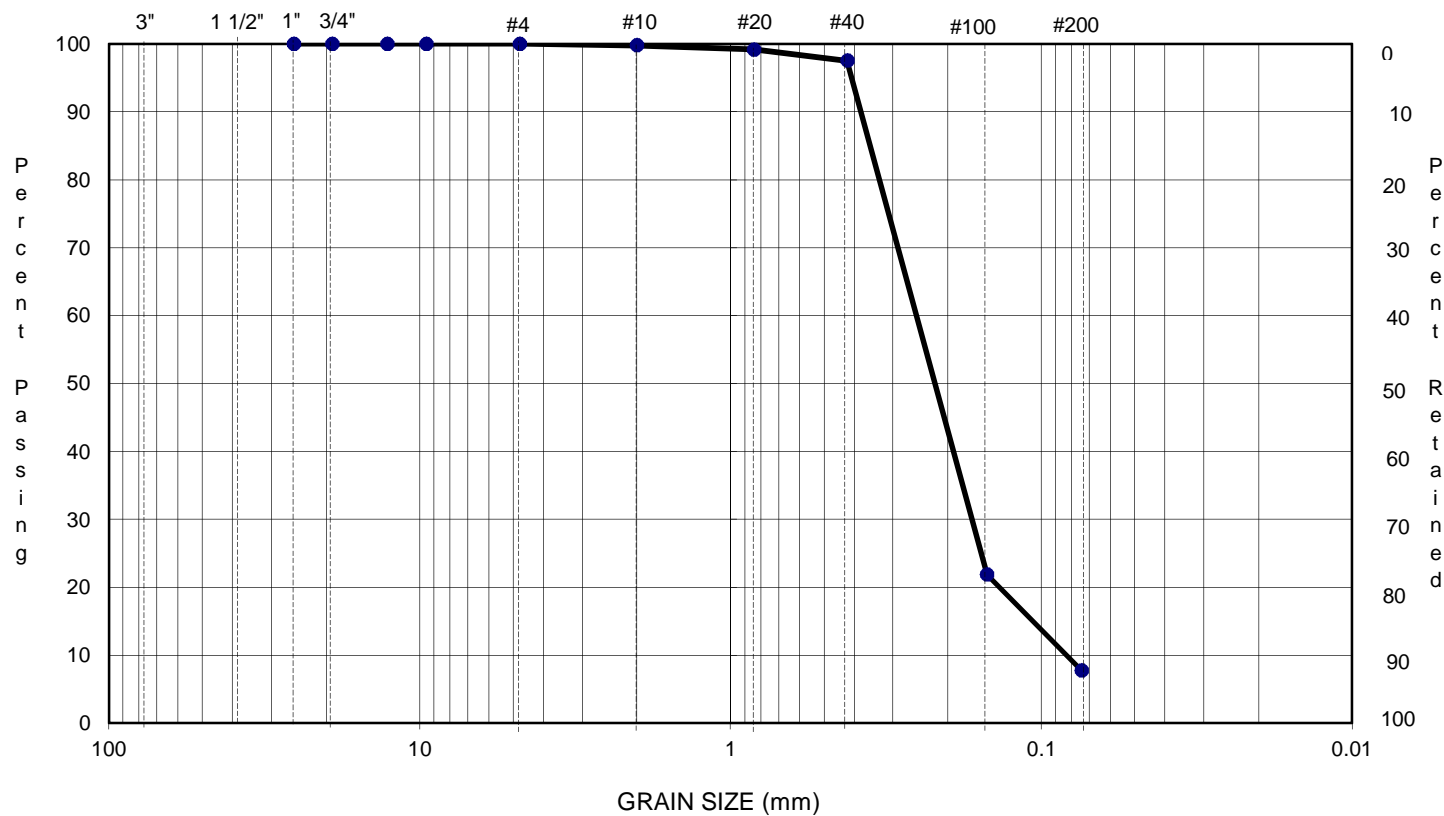
Sample Description:

light gray sand with silt

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	99
# 40	97
# 100	22
# 200	7.7



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Thiele Geotech Inc.

# GRAIN SIZE CURVE

Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

12/28/15

Sample Identification:

PH-2 S-14

Sample Description:

light gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	99
-----	----

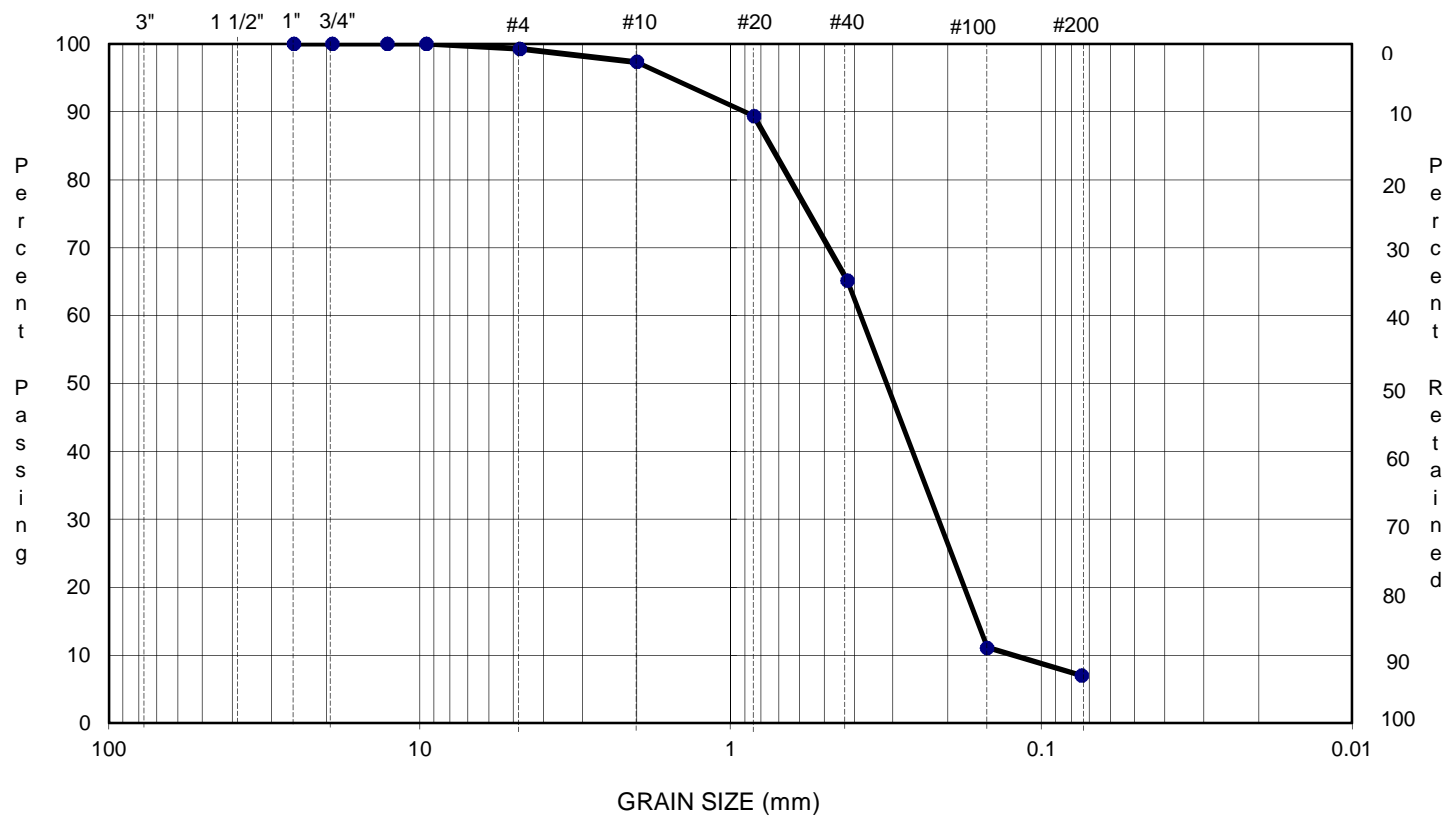
# 10	97
------	----

# 20	89
------	----

# 40	65
------	----

# 100	11
-------	----

# 200	7.0
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-3 S-4

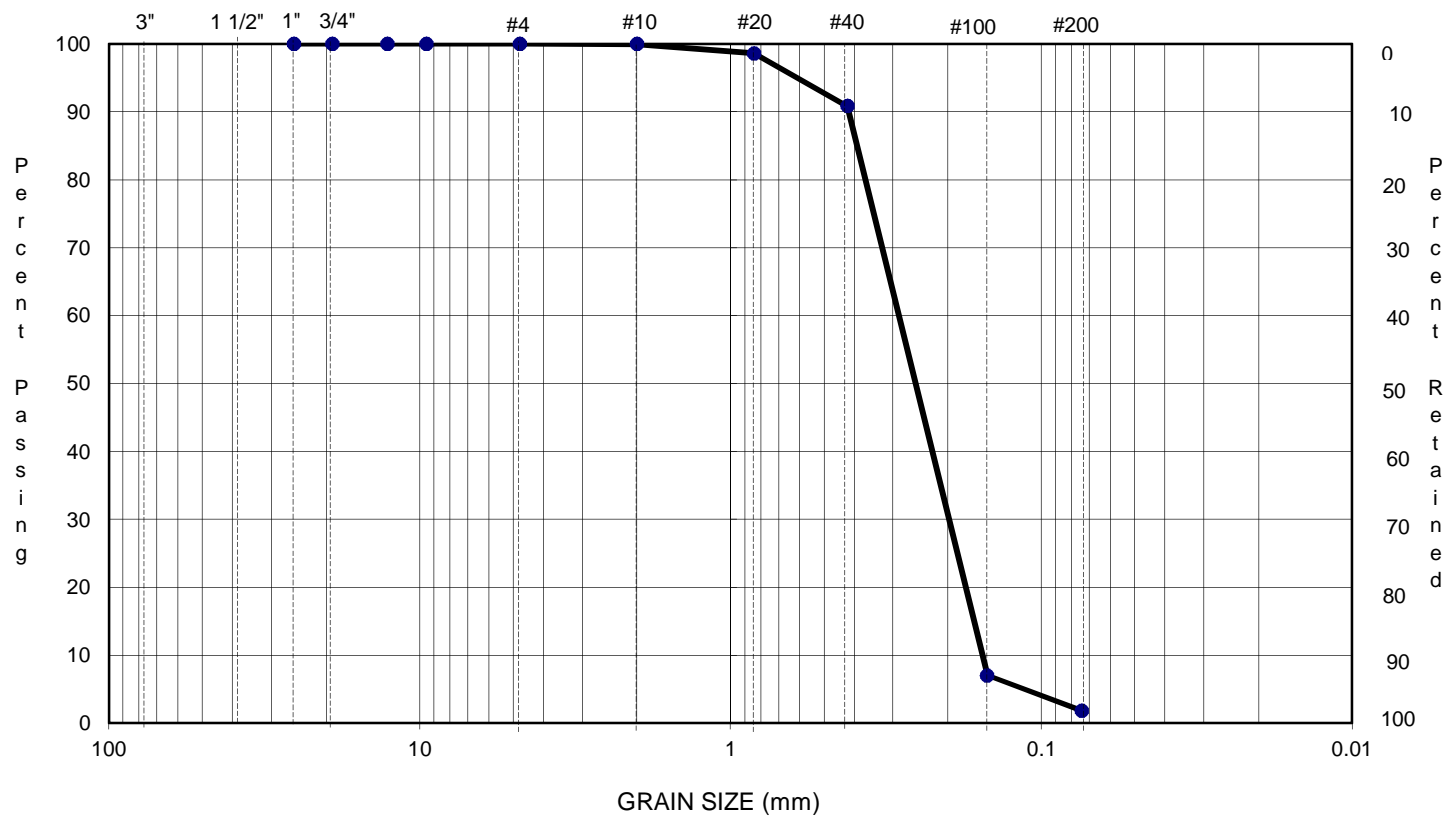
Sample Description:

brown sand

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	99
# 40	91
# 100	7.0
# 200	1.9



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-3 S-6

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	99
------	----

# 4	99
-----	----

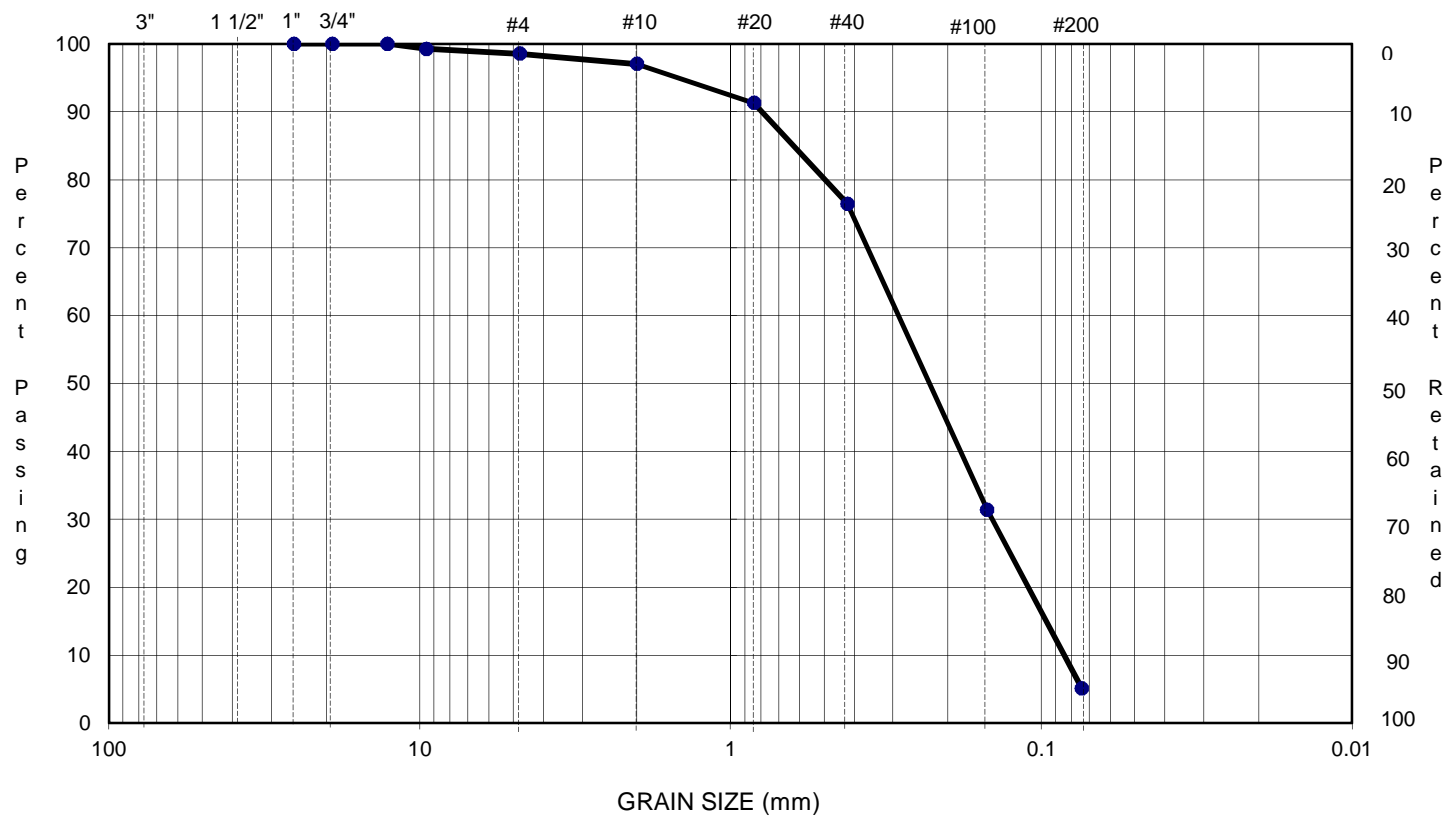
# 10	97
------	----

# 20	91
------	----

# 40	76
------	----

# 100	31
-------	----

# 200	5.2
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_





Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-3 S-7

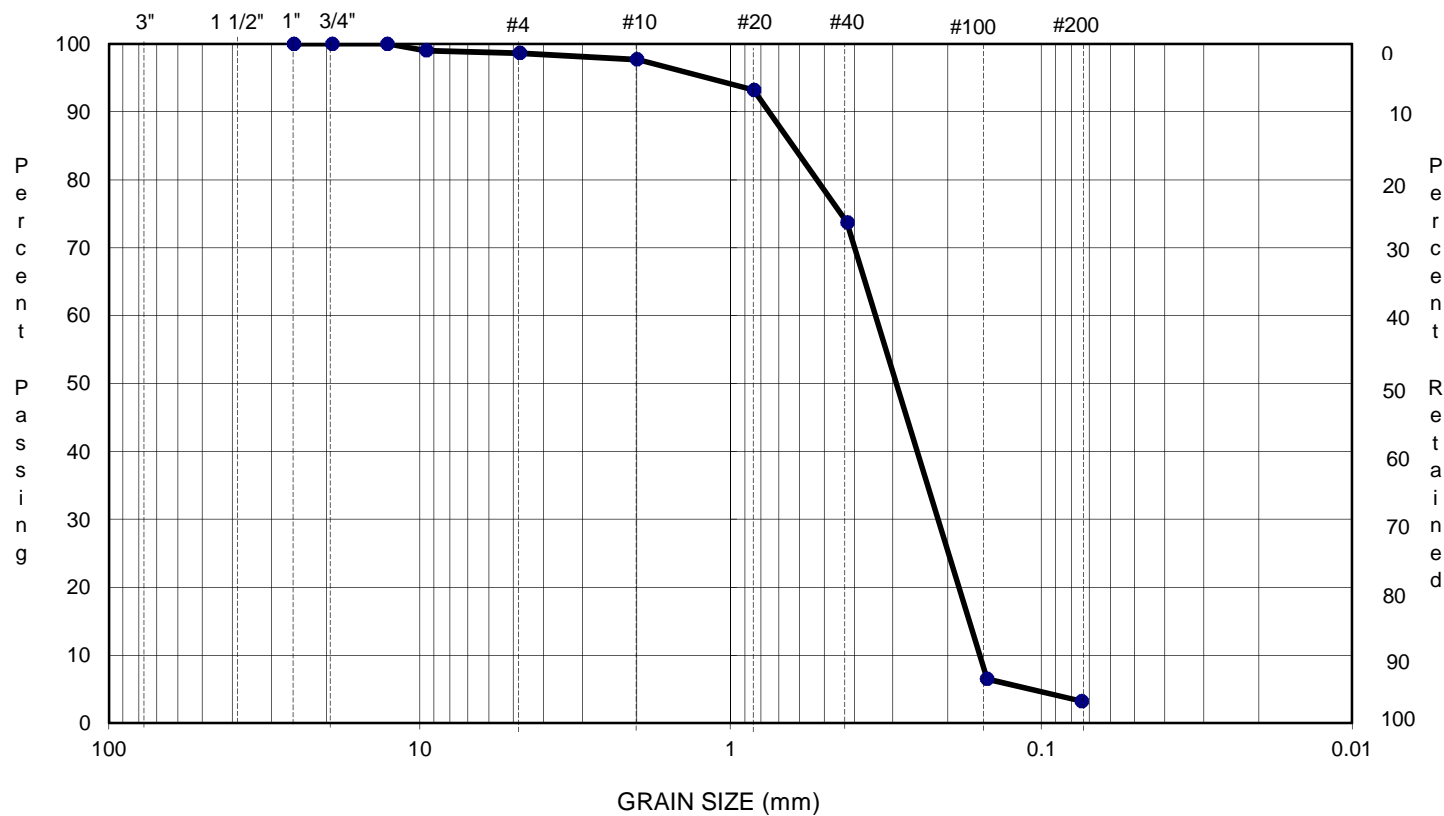
Sample Description:

gray sand

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	100
1/2"	100
3/8"	99
# 4	99
# 10	98
# 20	93
# 40	74
# 100	6.5
# 200	3.2



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-3 S-8

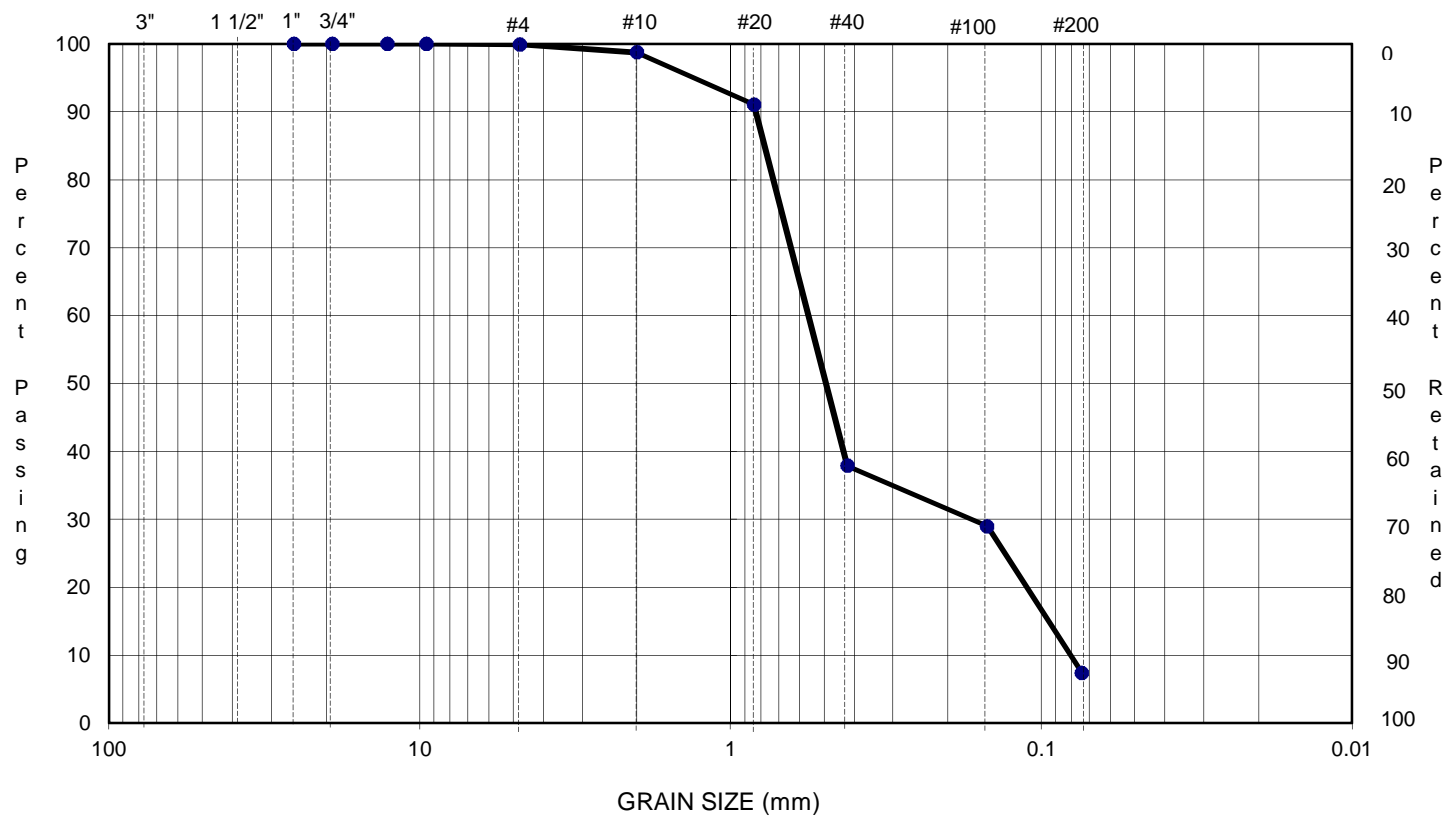
Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	99
# 20	91
# 40	38
# 100	29
# 200	7.4



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-3 S-9

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	99
-----	----

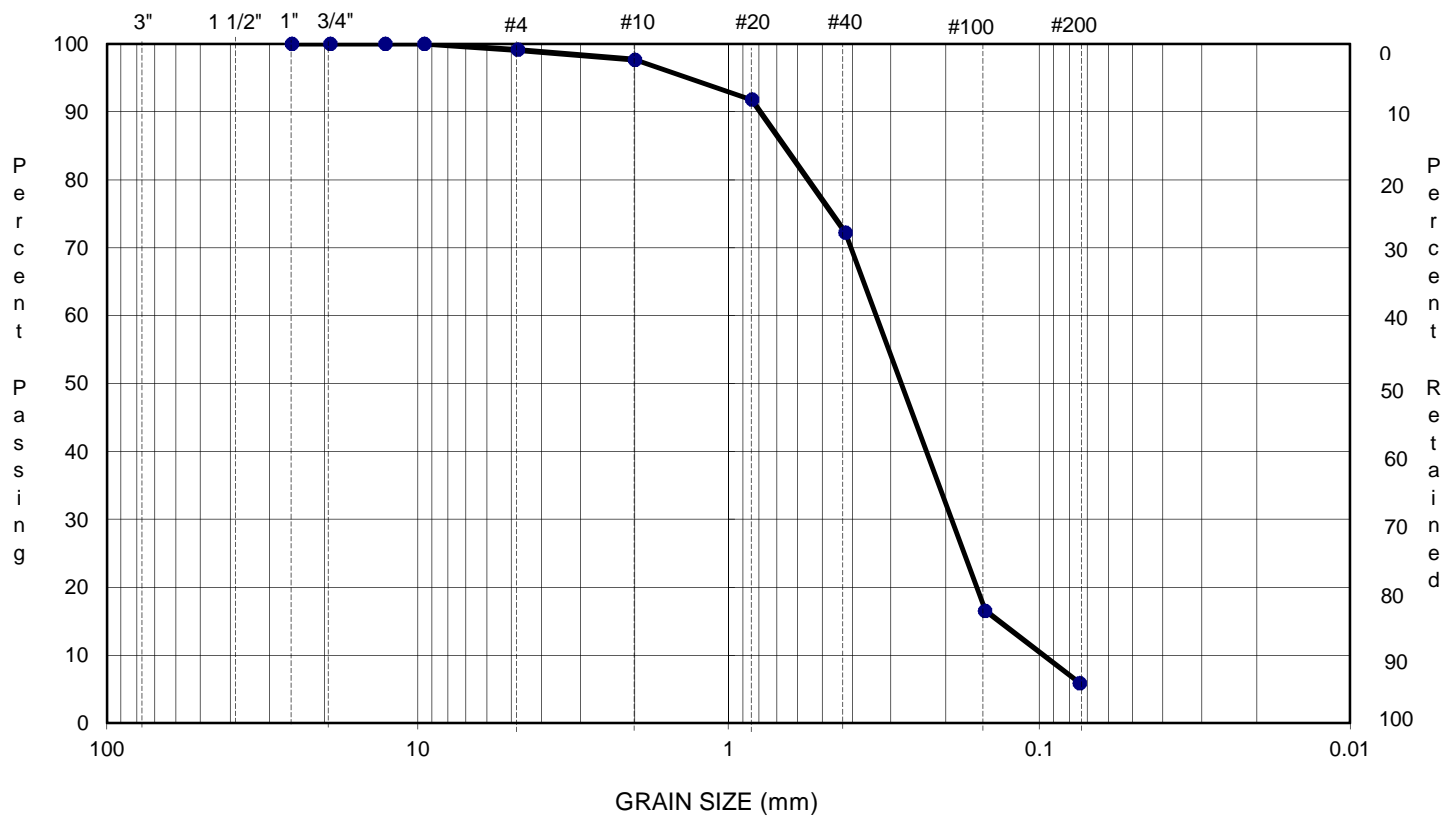
# 10	98
------	----

# 20	92
------	----

# 40	72
------	----

# 100	17
-------	----

# 200	5.9
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-3 S-10

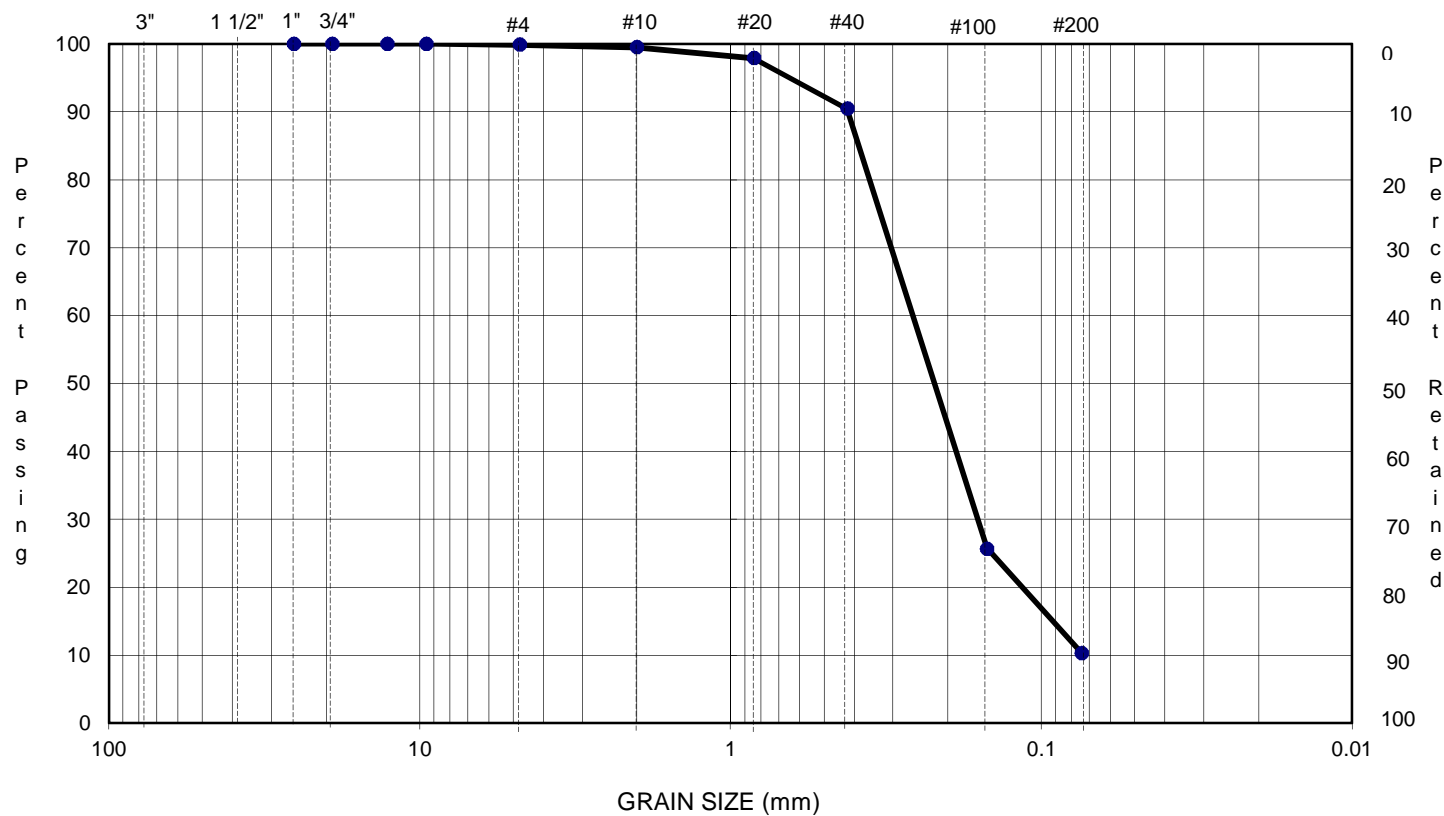
Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	99
# 20	98
# 40	90
# 100	26
# 200	10.3



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-3 S-11

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

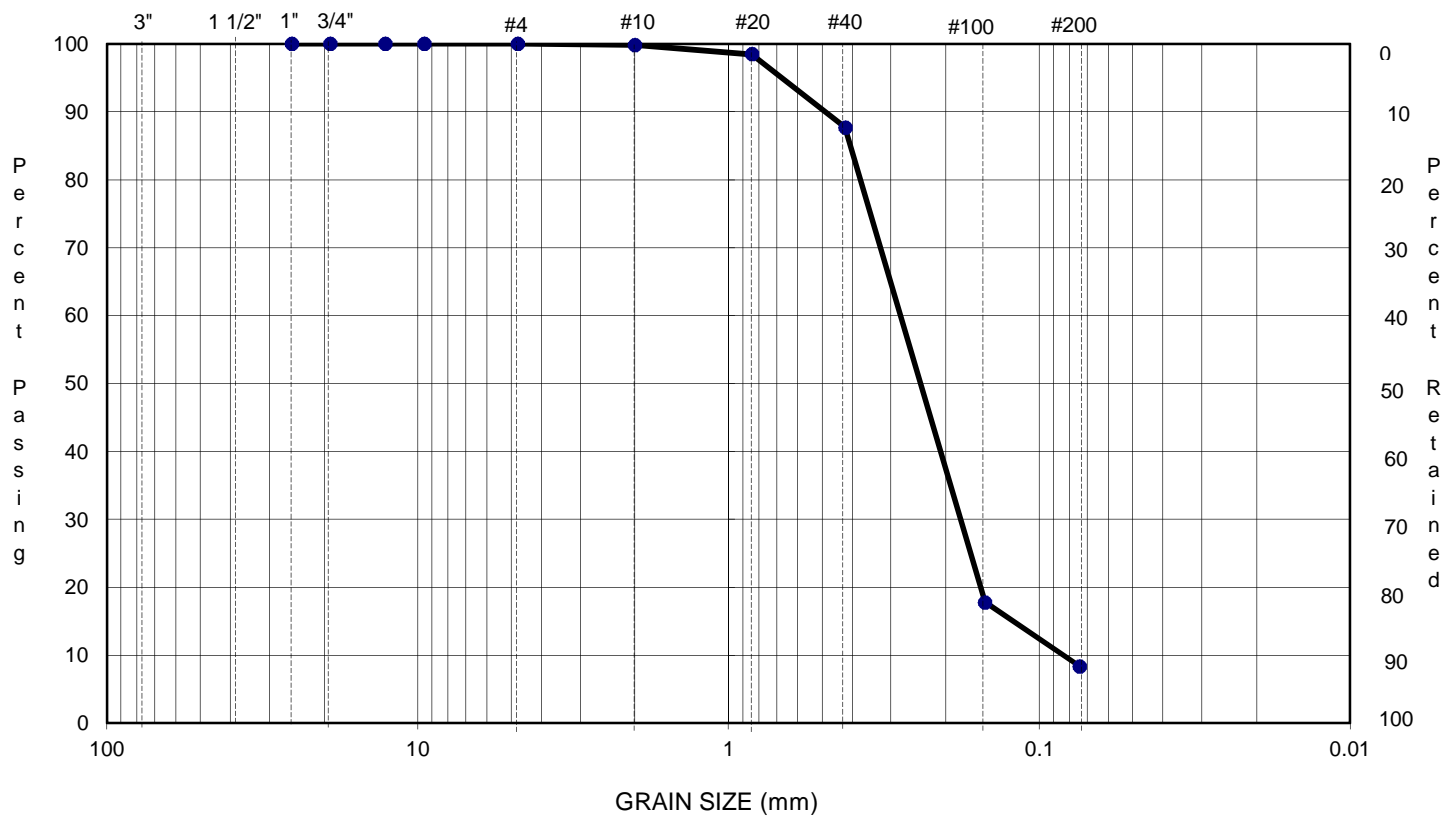
# 10	100
------	-----

# 20	98
------	----

# 40	88
------	----

# 100	18
-------	----

# 200	8.4
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-3 S-13

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

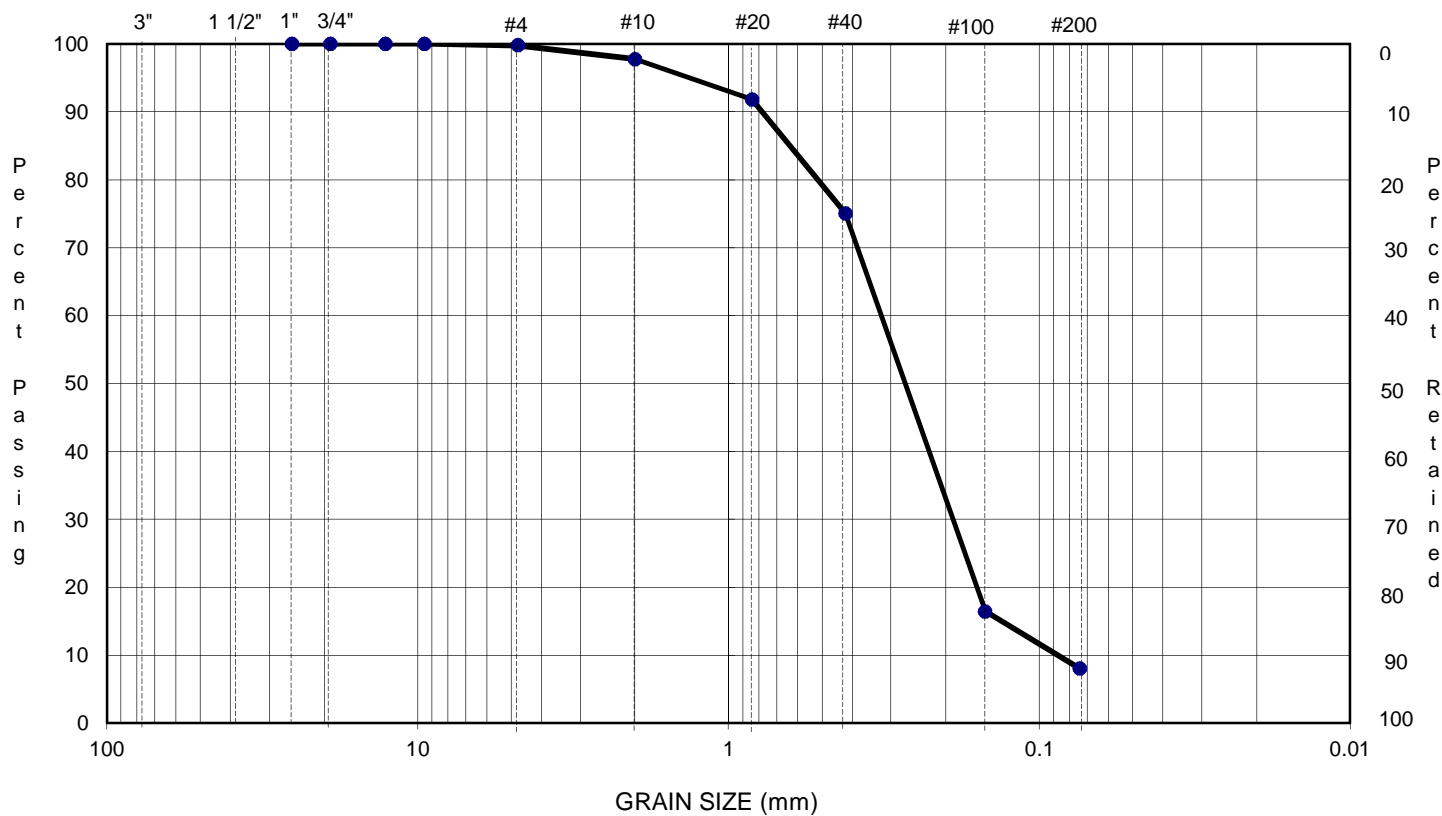
# 10	98
------	----

# 20	92
------	----

# 40	75
------	----

# 100	16
-------	----

# 200	8.0
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-4 S-5

Sample Description:

grayish brown silty sand

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

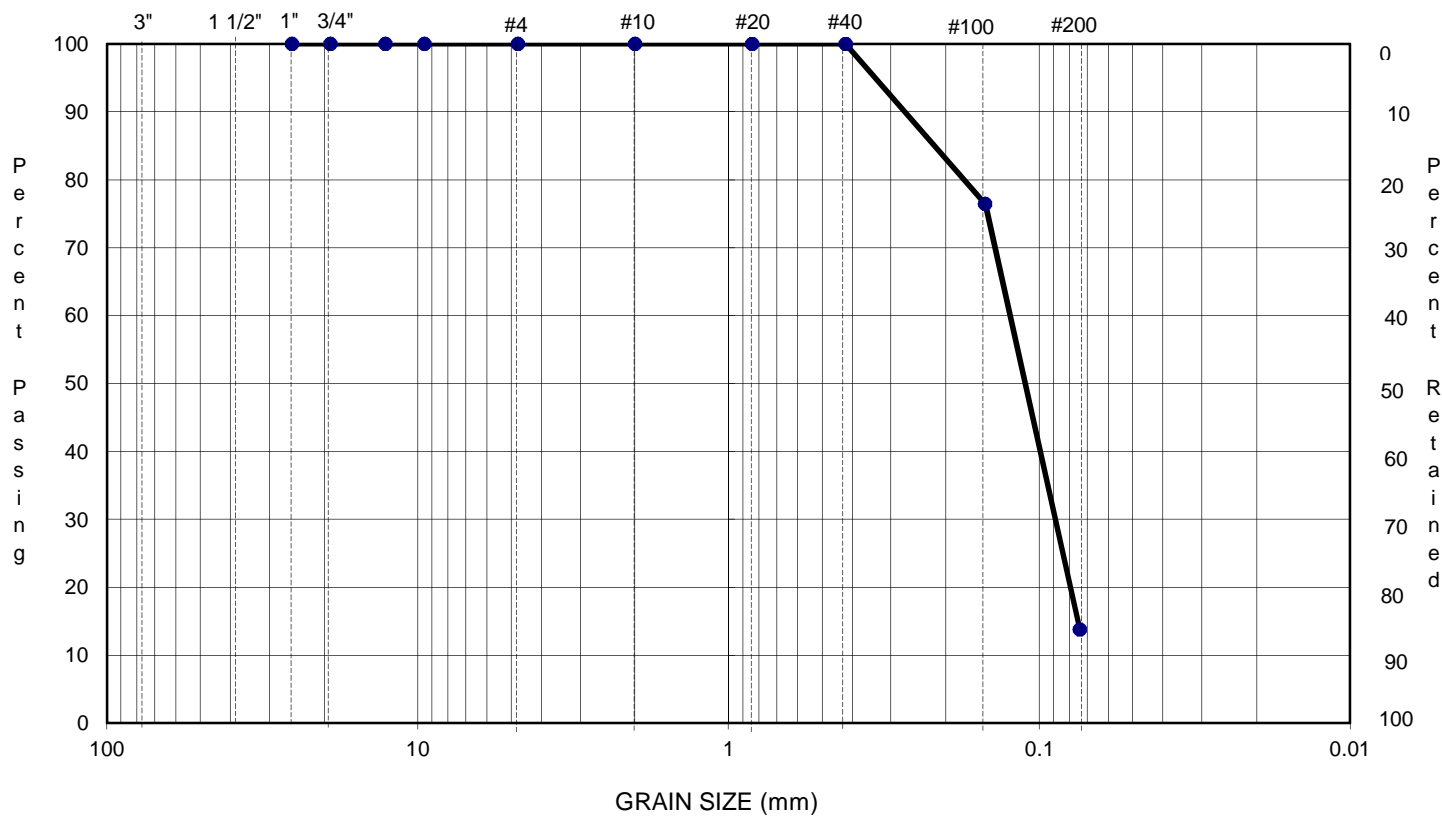
# 10	100
------	-----

# 20	100
------	-----

# 40	100
------	-----

# 100	76
-------	----

# 200	13.8
-------	------



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-4 S-7

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

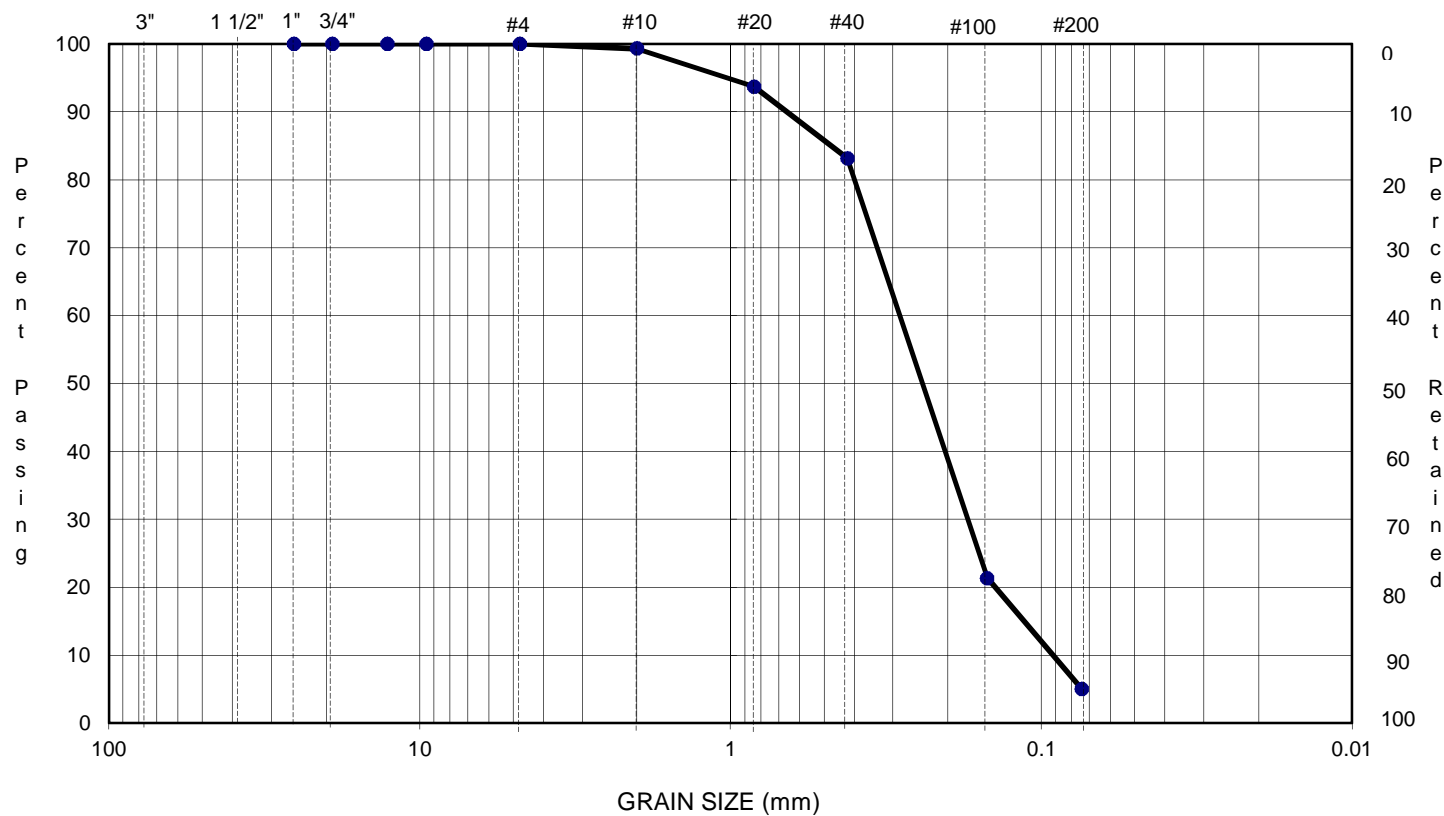
# 10	99
------	----

# 20	94
------	----

# 40	83
------	----

# 100	21
-------	----

# 200	5.0
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_





Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-4 S-8

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

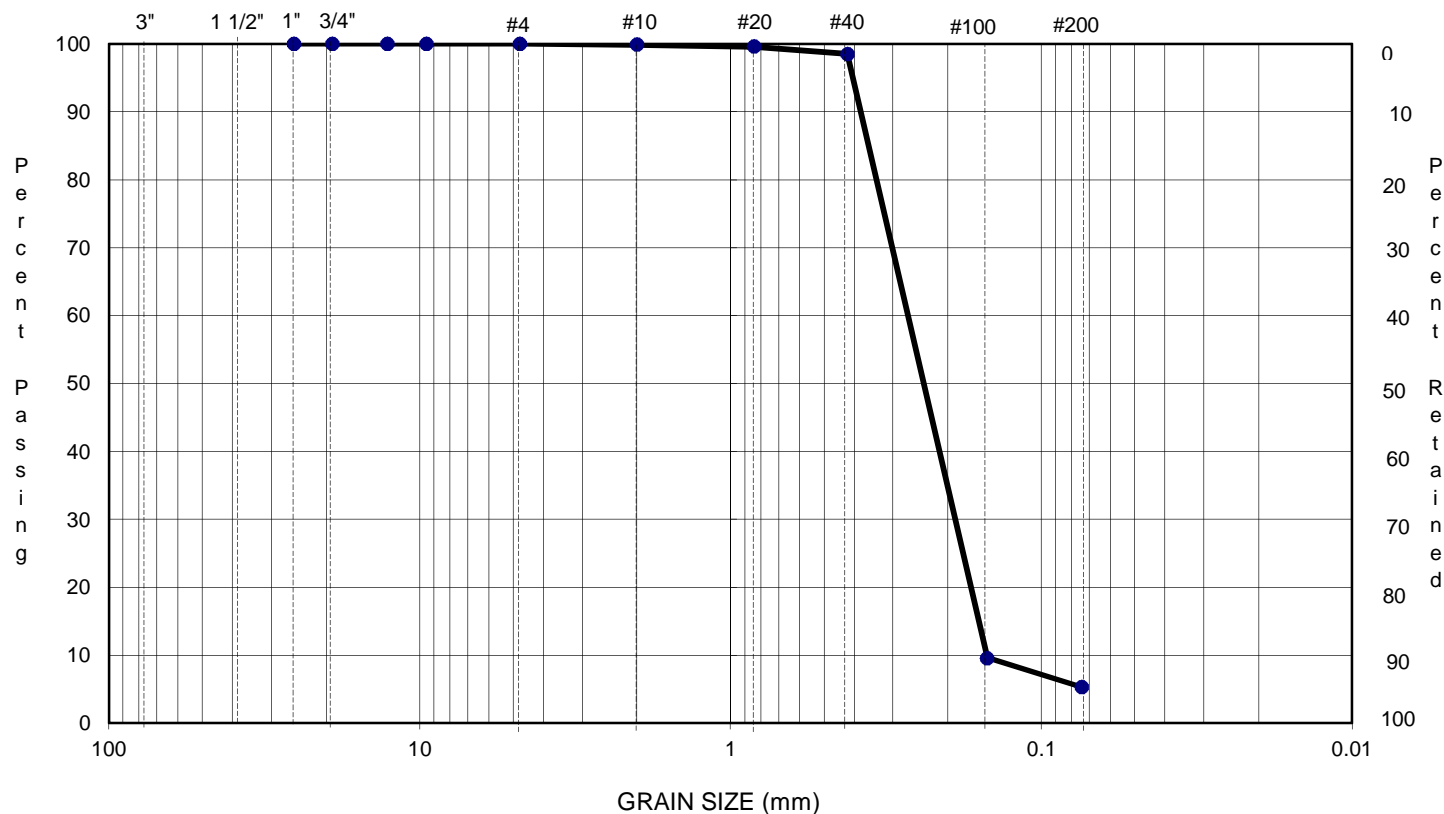
# 10	100
------	-----

# 20	100
------	-----

# 40	98
------	----

# 100	10
-------	----

# 200	5.3
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-4 S-9

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

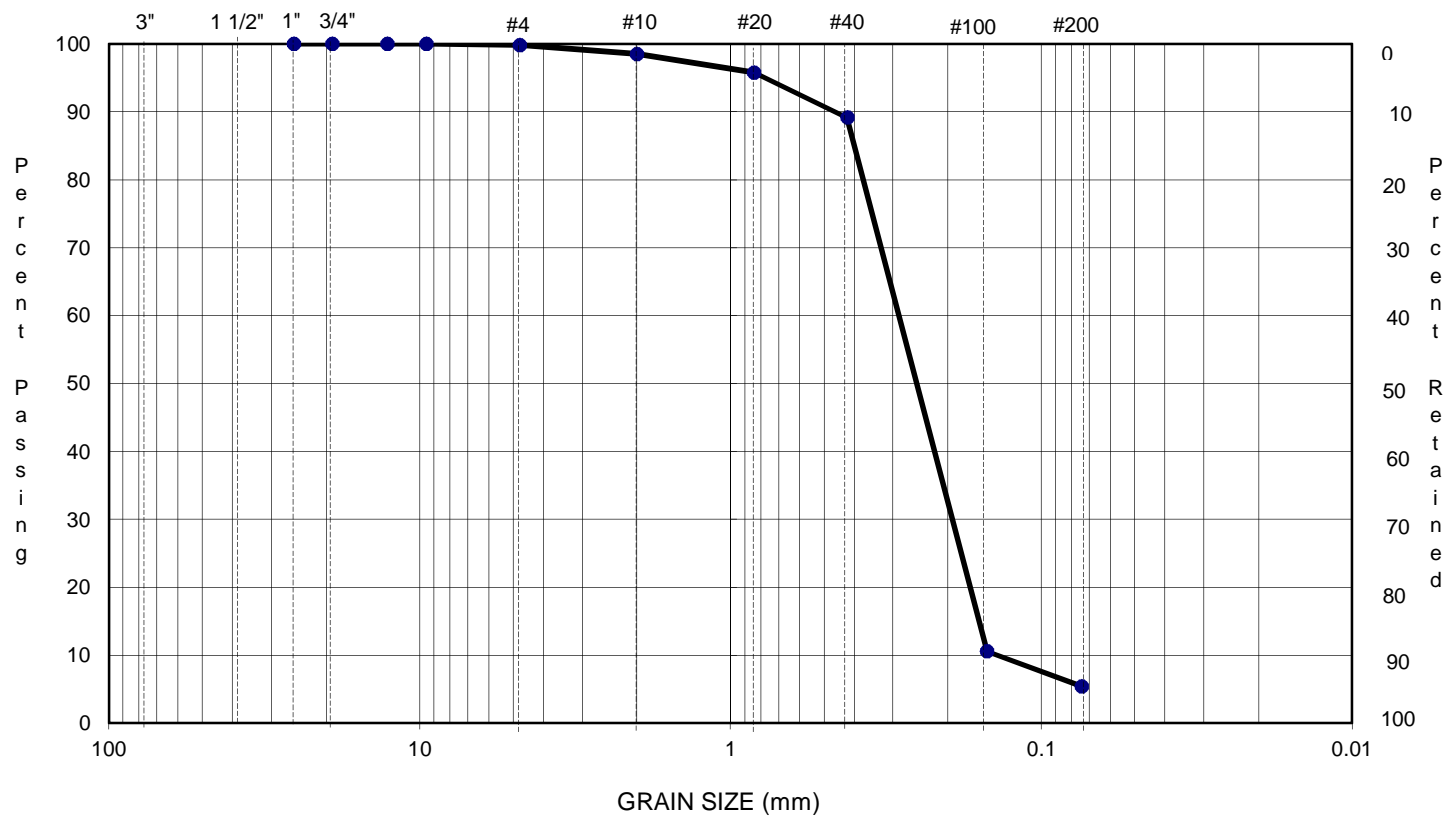
# 10	98
------	----

# 20	96
------	----

# 40	89
------	----

# 100	11
-------	----

# 200	5.4
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-4 S-10

Sample Description:

gray sand

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	99
-----	----

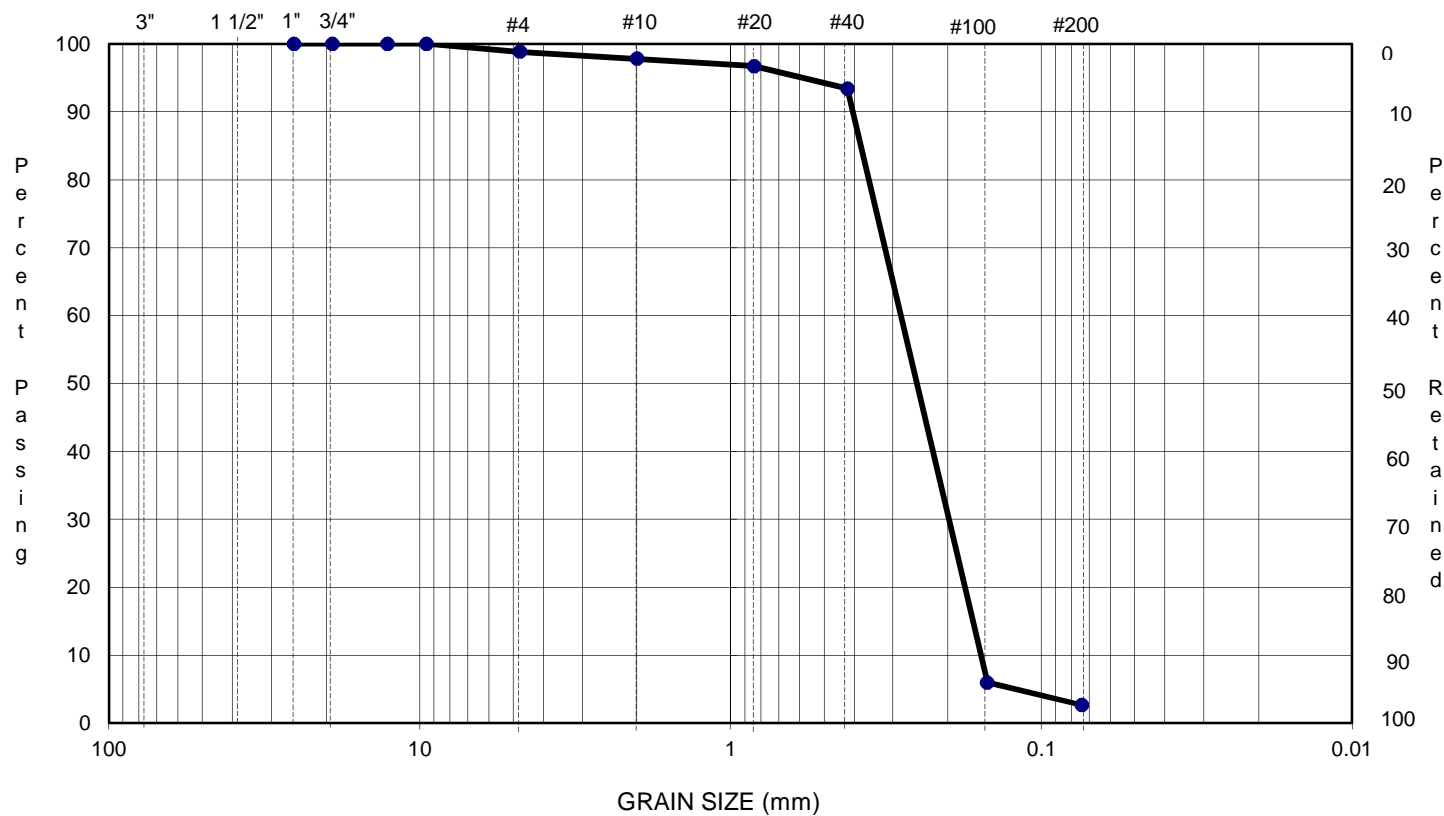
# 10	98
------	----

# 20	97
------	----

# 40	93
------	----

# 100	6.0
-------	-----

# 200	2.7
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-4 S-11

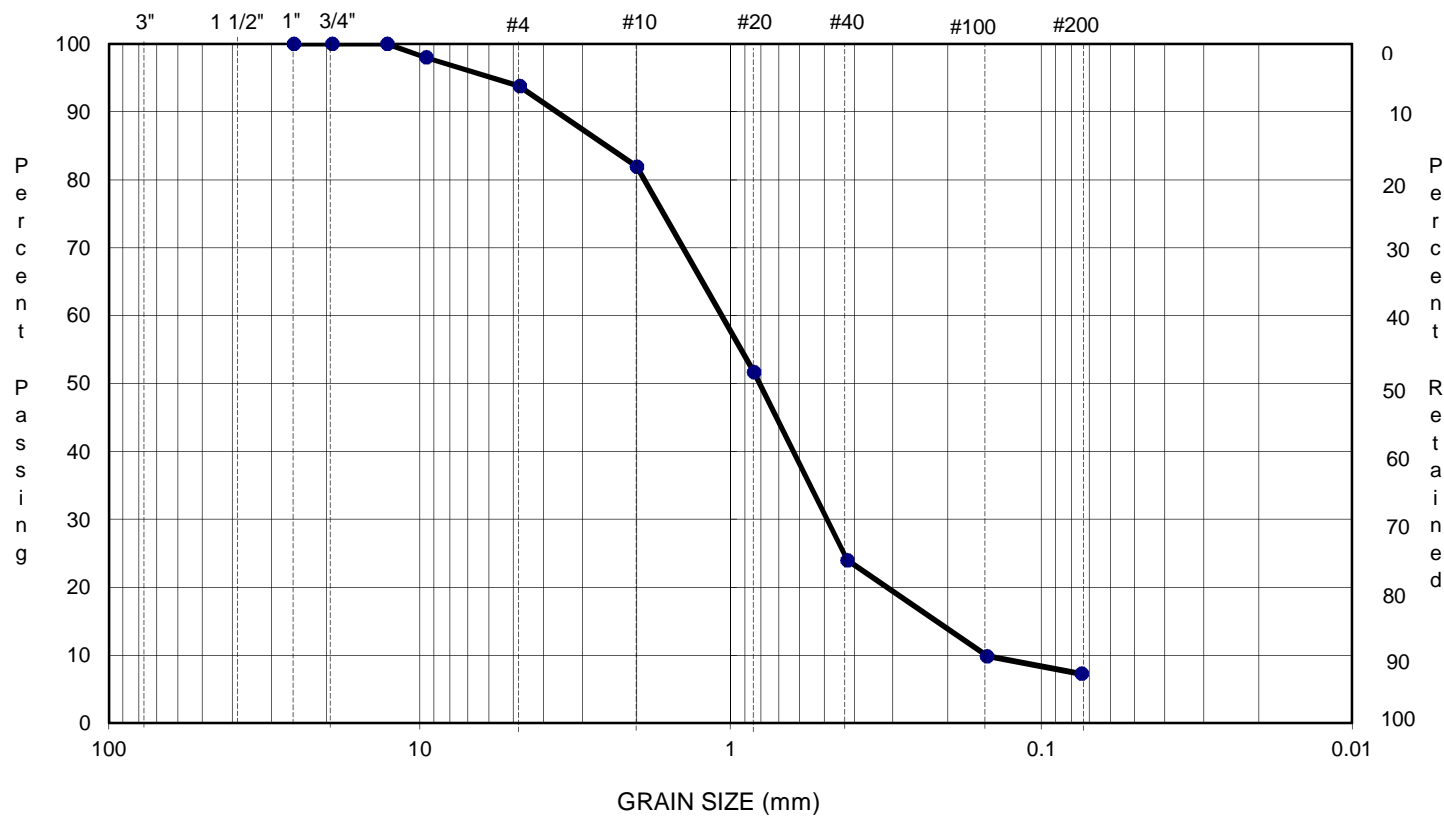
Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size % Finer

1"	100
3/4"	100
1/2"	100
3/8"	98
# 4	94
# 10	82
# 20	52
# 40	24
# 100	9.9
# 200	7.2



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-4 S-12

Sample Description:

gray sand

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	99
------	----

# 4	95
-----	----

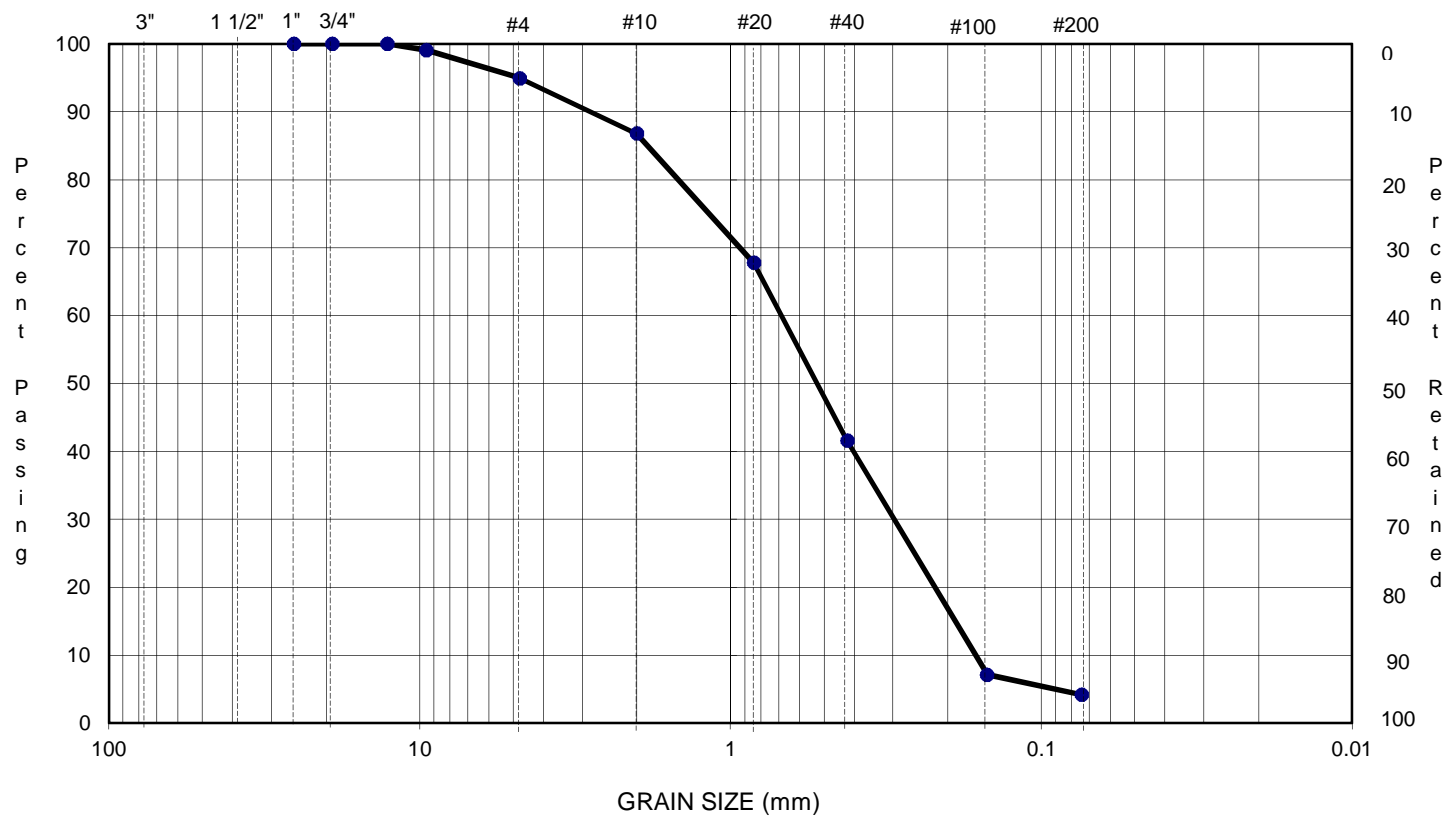
# 10	87
------	----

# 20	68
------	----

# 40	42
------	----

# 100	7.1
-------	-----

# 200	4.2
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-4 S-14

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

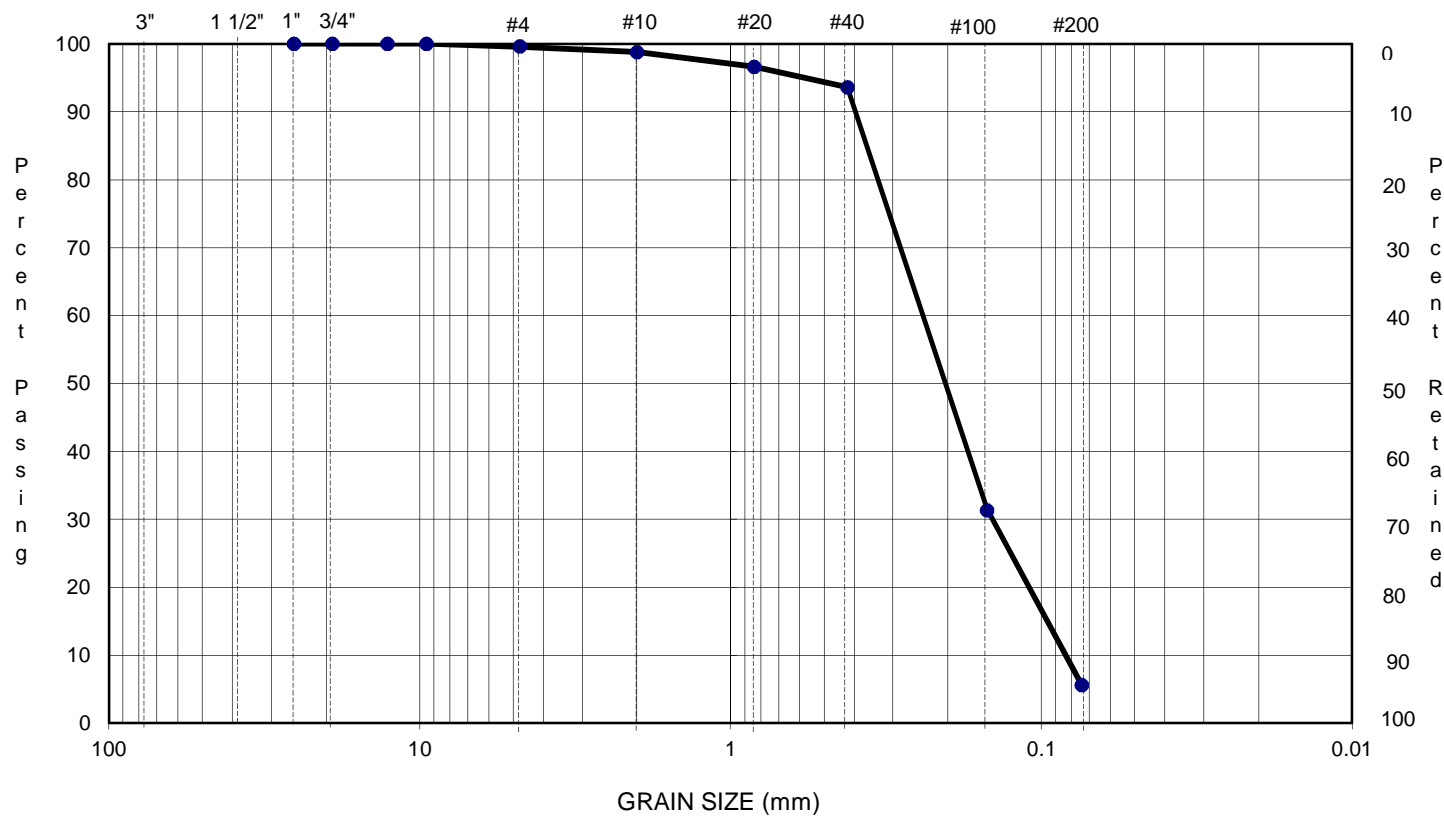
# 10	99
------	----

# 20	97
------	----

# 40	94
------	----

# 100	31
-------	----

# 200	5.6
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-5 U-3

Sample Description:

gray sand

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

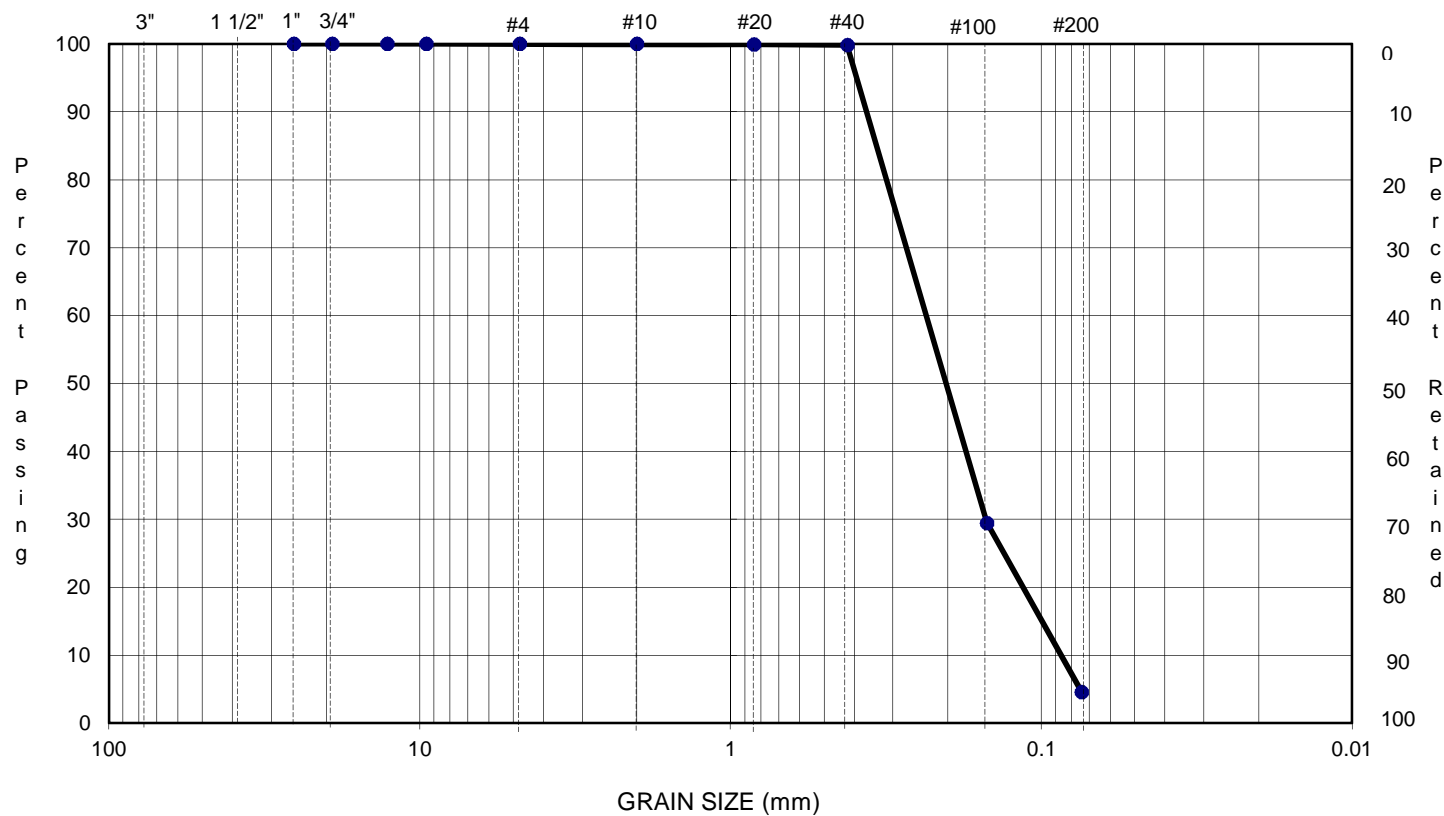
# 10	100
------	-----

# 20	100
------	-----

# 40	100
------	-----

# 100	29
-------	----

# 200	4.5
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-5 S-4

Sample Description:

light brownish gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

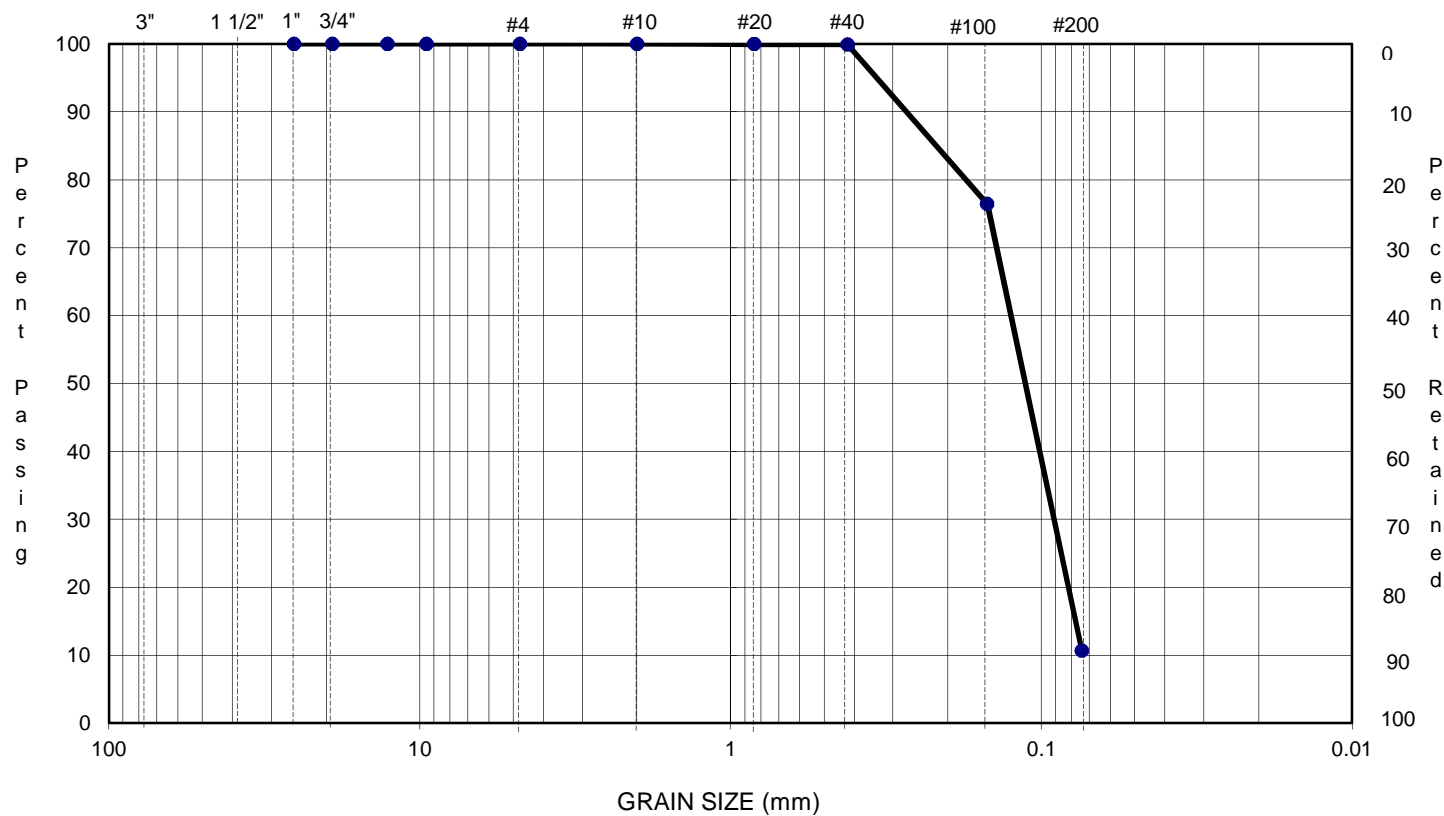
# 10	100
------	-----

# 20	100
------	-----

# 40	100
------	-----

# 100	76
-------	----

# 200	10.7
-------	------



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_





Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-5 S-6

Sample Description:

gray silty sand

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

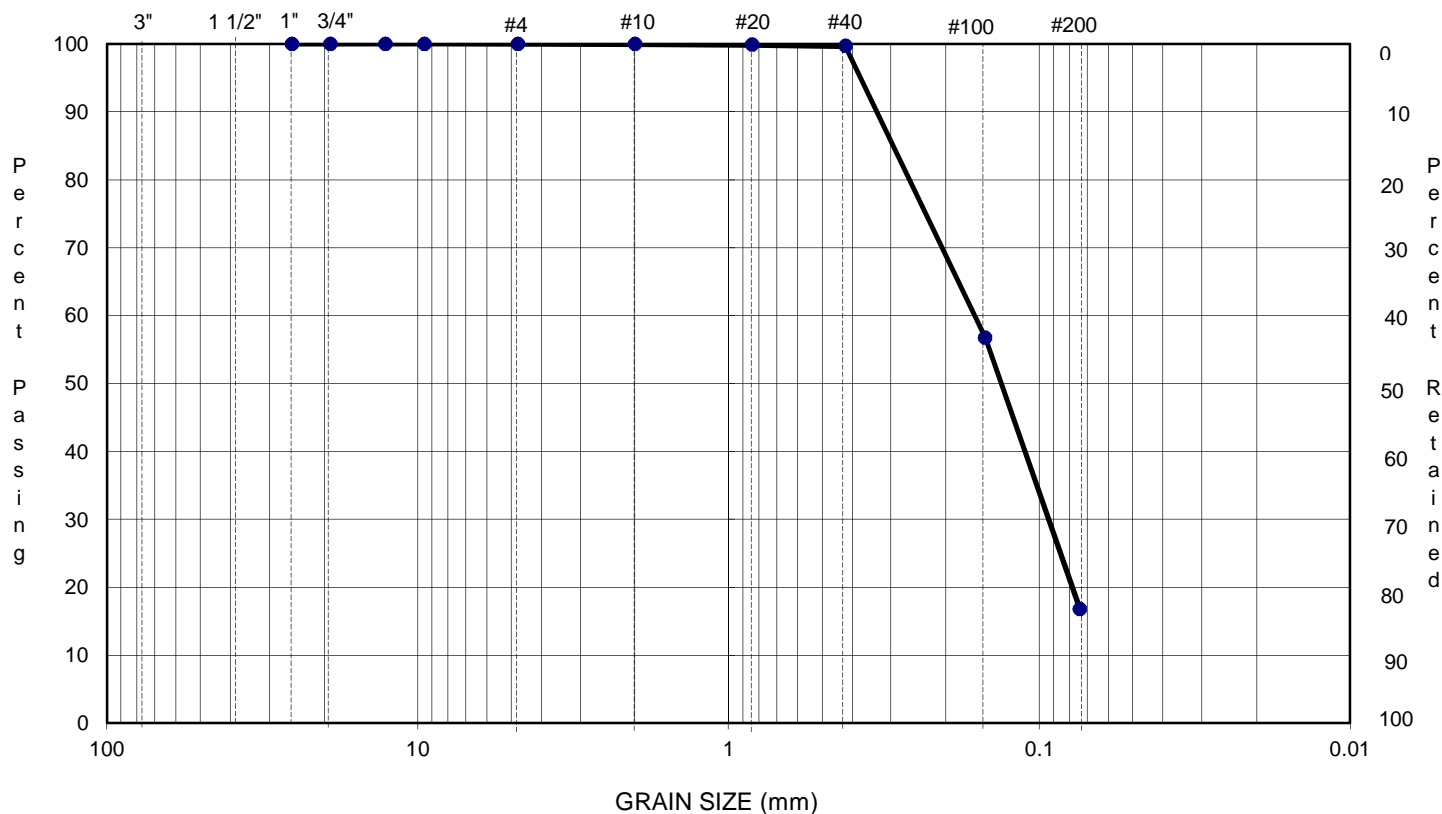
# 10	100
------	-----

# 20	100
------	-----

# 40	100
------	-----

# 100	57
-------	----

# 200	16.8
-------	------



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-5 S-8

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	99
------	----

# 4	98
-----	----

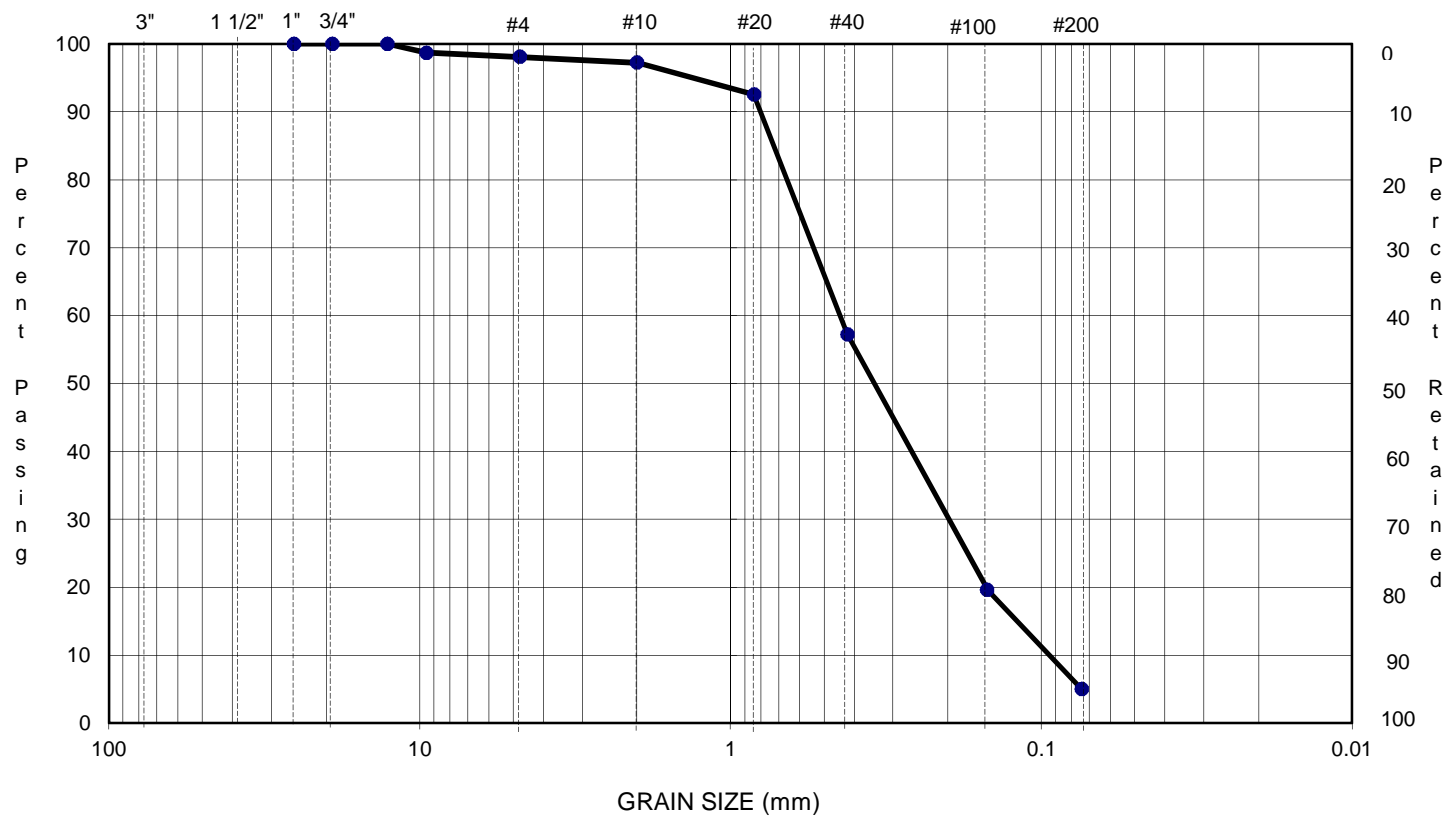
# 10	97
------	----

# 20	92
------	----

# 40	57
------	----

# 100	20
-------	----

# 200	5.0
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-5 S-9

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	98
-----	----

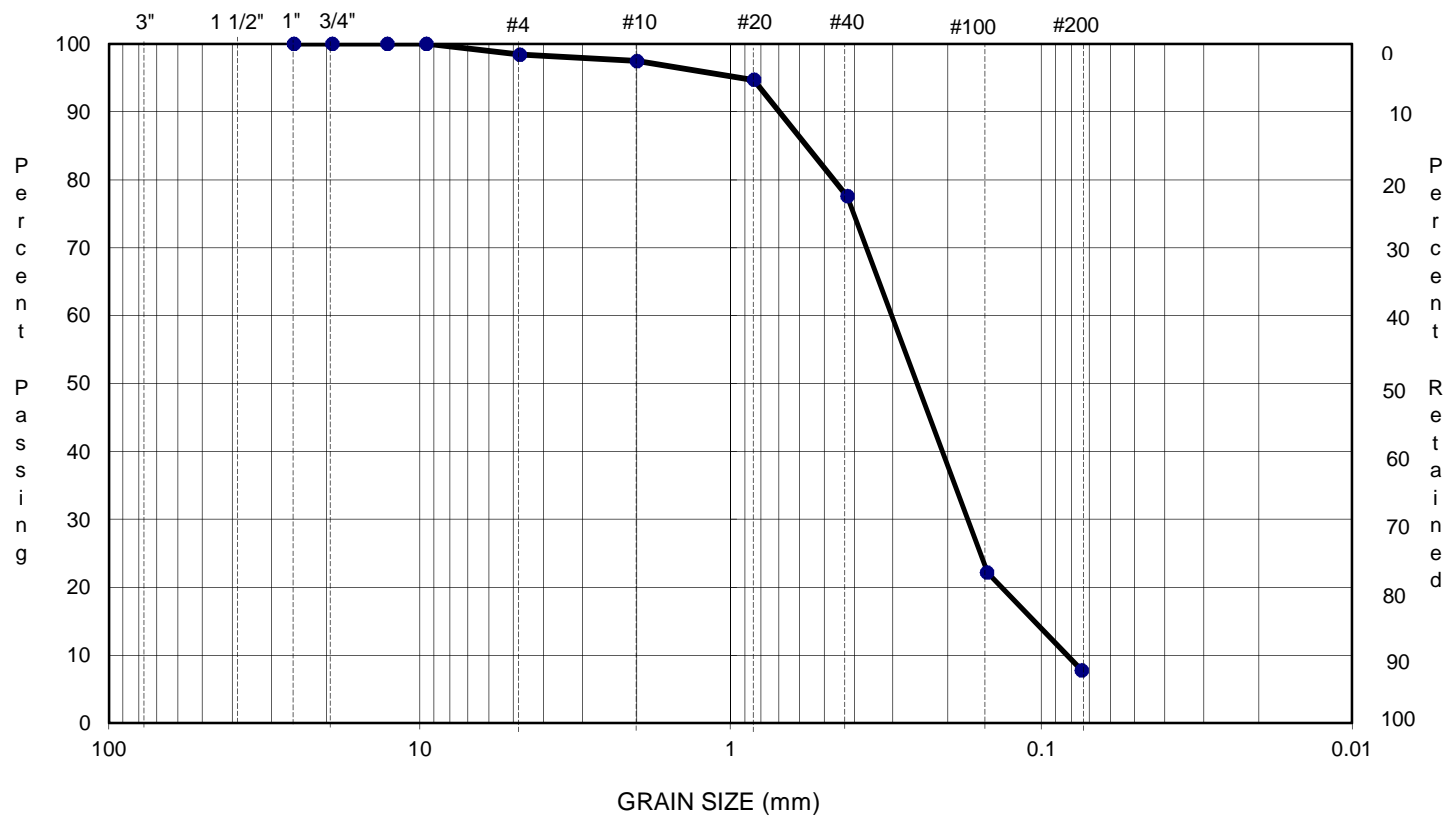
# 10	97
------	----

# 20	95
------	----

# 40	78
------	----

# 100	22
-------	----

# 200	7.8
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-5 S-10

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	100
-----	-----

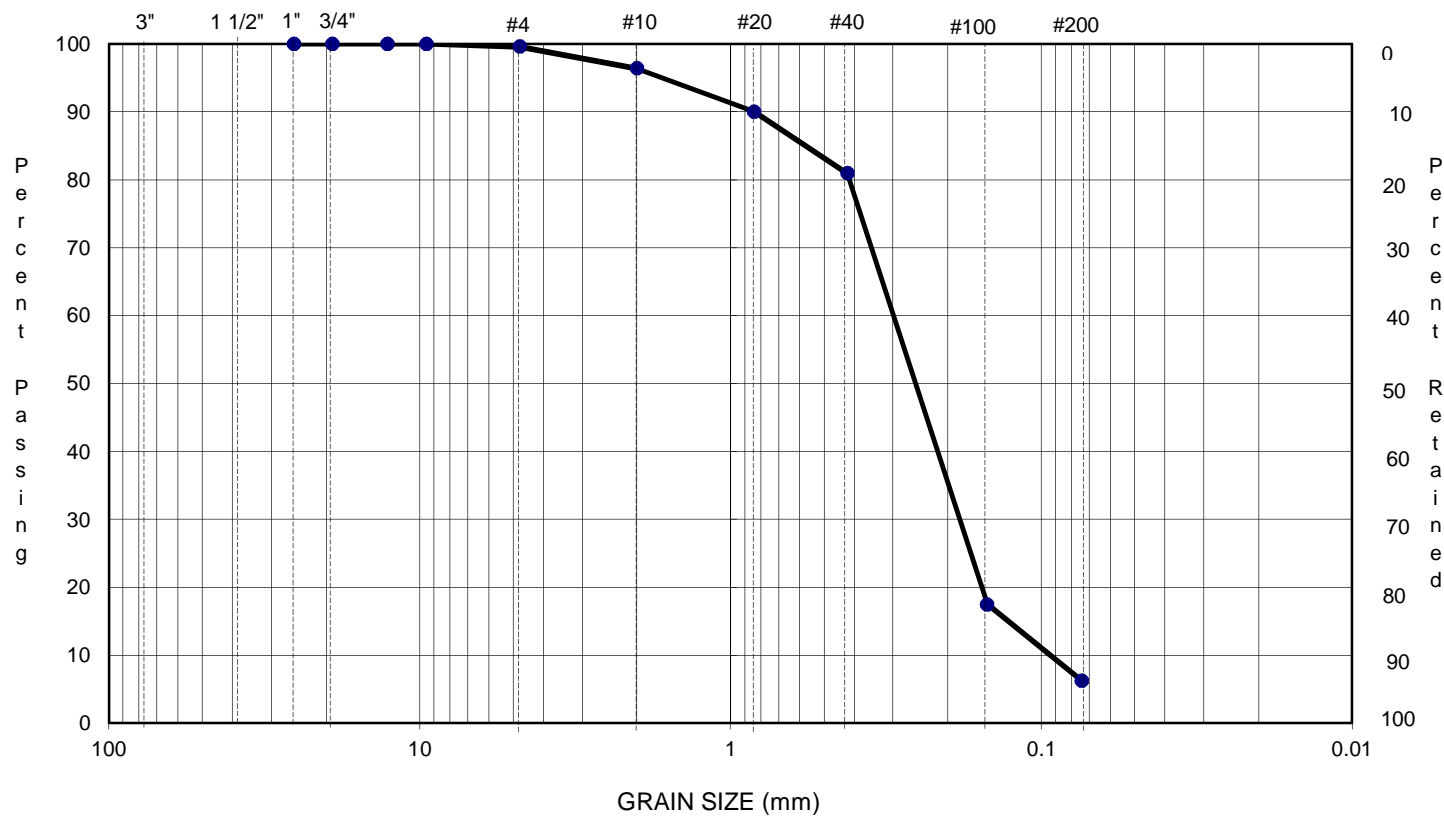
# 10	96
------	----

# 20	90
------	----

# 40	81
------	----

# 100	17
-------	----

# 200	6.3
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-5 S-11

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	99
------	----

# 4	98
-----	----

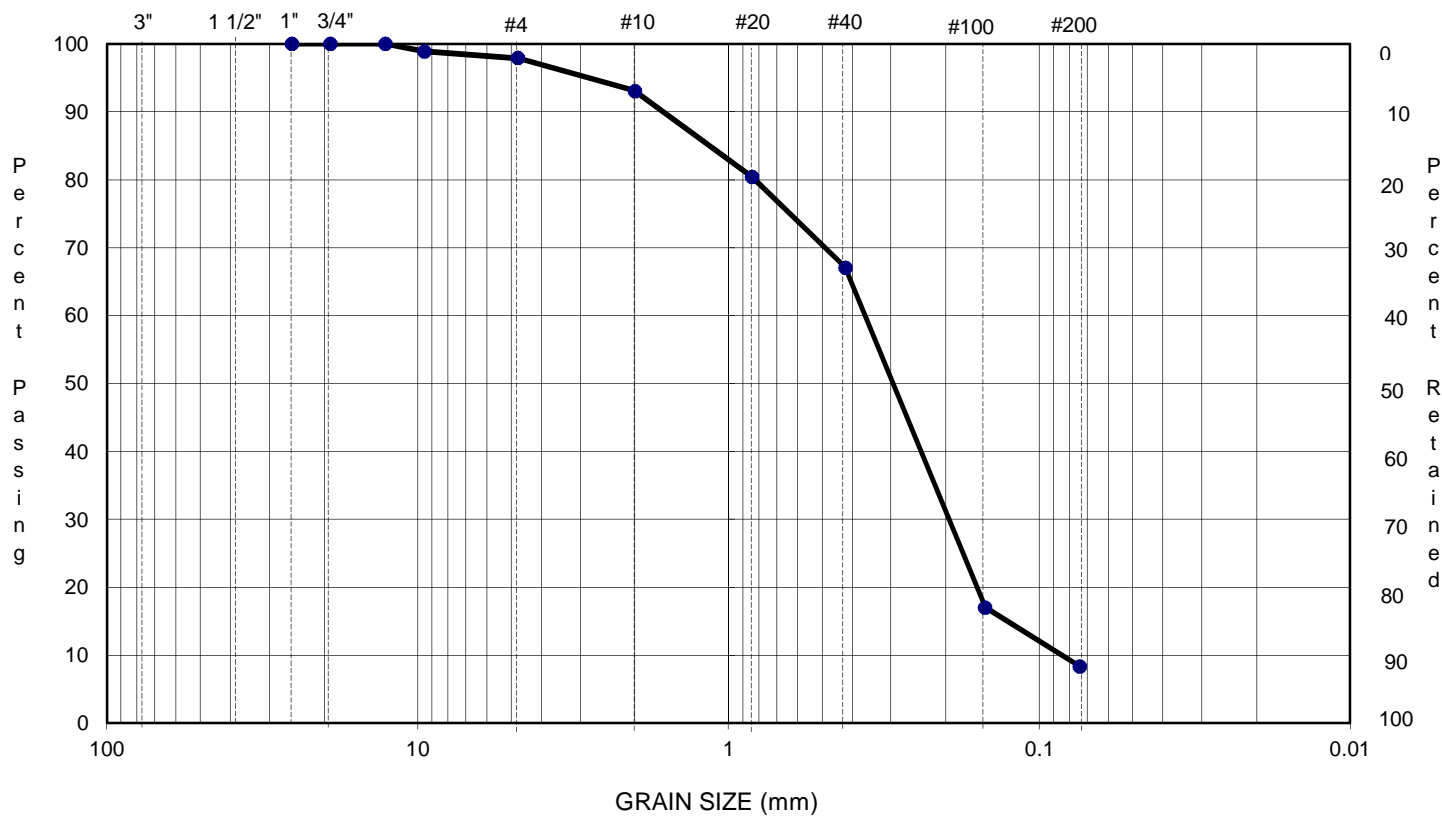
# 10	93
------	----

# 20	80
------	----

# 40	67
------	----

# 100	17
-------	----

# 200	8.4
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



Project

Job No.

Relief Well Pilot Holes - Industrial Park Levee

15756.00

Location

Date

River Road, Council Bluffs, IA

1/5/16

Sample Identification:

PH-5 S-13

Sample Description:

gray sand with silt

## SIEVE ANALYSIS

Size	% Finer
------	---------

1"	100
----	-----

3/4"	100
------	-----

1/2"	100
------	-----

3/8"	100
------	-----

# 4	99
-----	----

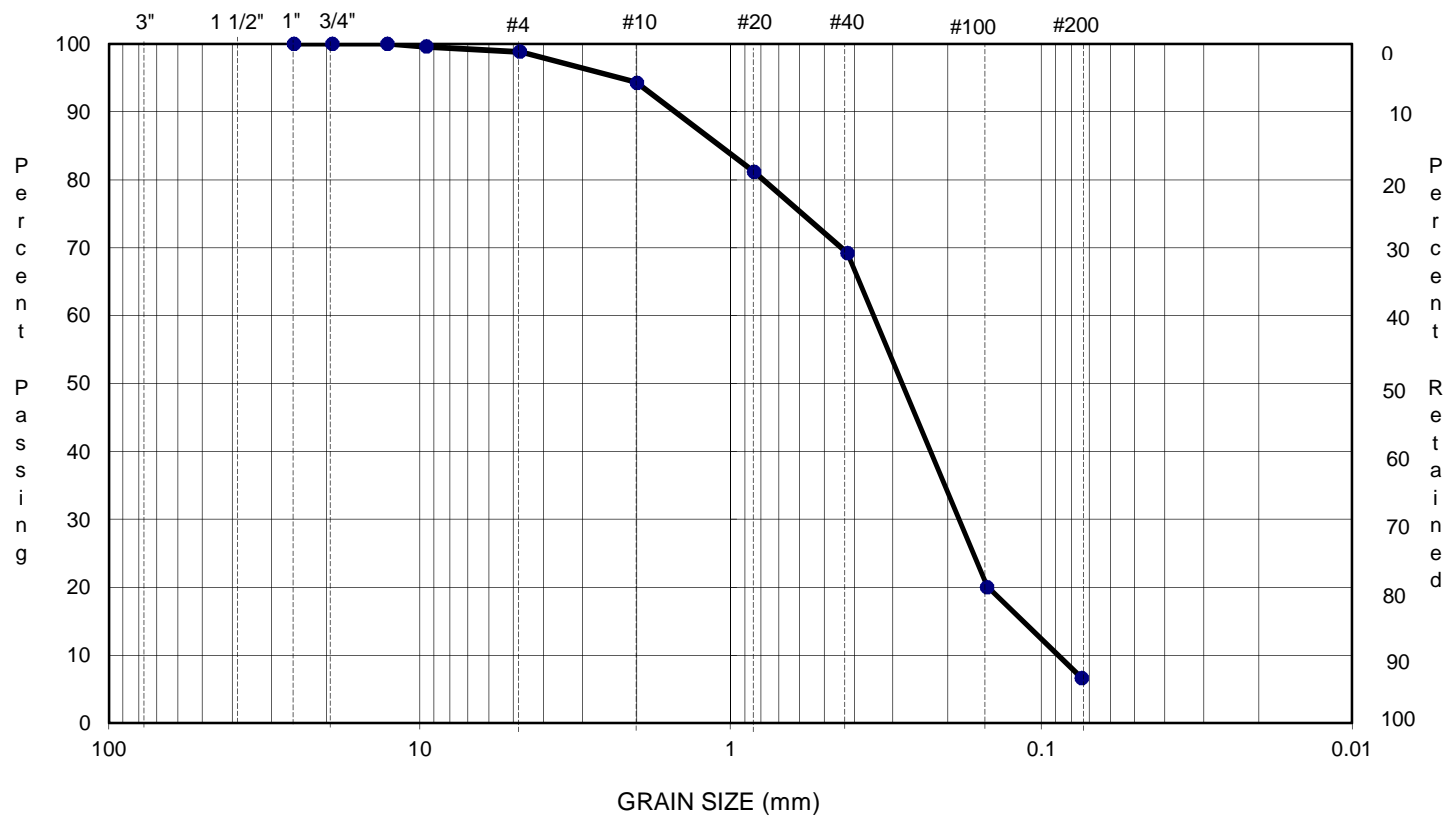
# 10	94
------	----

# 20	81
------	----

# 40	69
------	----

# 100	20
-------	----

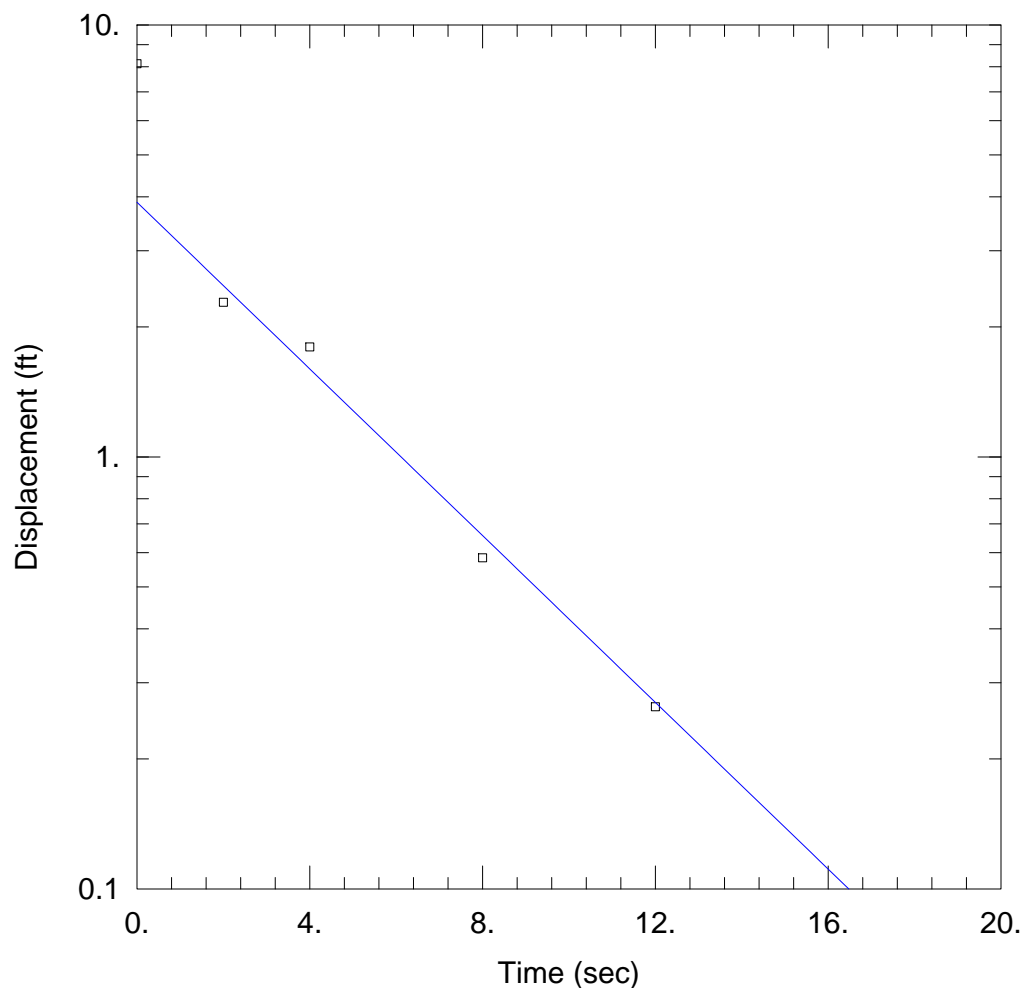
# 200	6.6
-------	-----



## UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES
---------------	-------------	-------------	-------------	-----------	-------

Lab No.: \_\_\_\_\_



### WELL TEST ANALYSIS

Data Set: C:\Program Files (x86)\HydroSOLVE\AQTESOLV Pro 4.0\TH-1.aqt

Date: 01/15/16

Time: 12:45:48

### PROJECT INFORMATION

Company: Thiele Geotech

Client: Griffin Dewatering

Project: 15756.00

Test Well: TH-1

Test Date: 1/7/16

### AQUIFER DATA

Saturated Thickness: 100. ft

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (New Well)

Initial Displacement: 8.13 ft

Static Water Column Height: 40. ft

Total Well Penetration Depth: 40. ft

Screen Length: 10. ft

Casing Radius: 0.083 ft

Well Radius: 0.66 ft

Gravel Pack Porosity: 0.

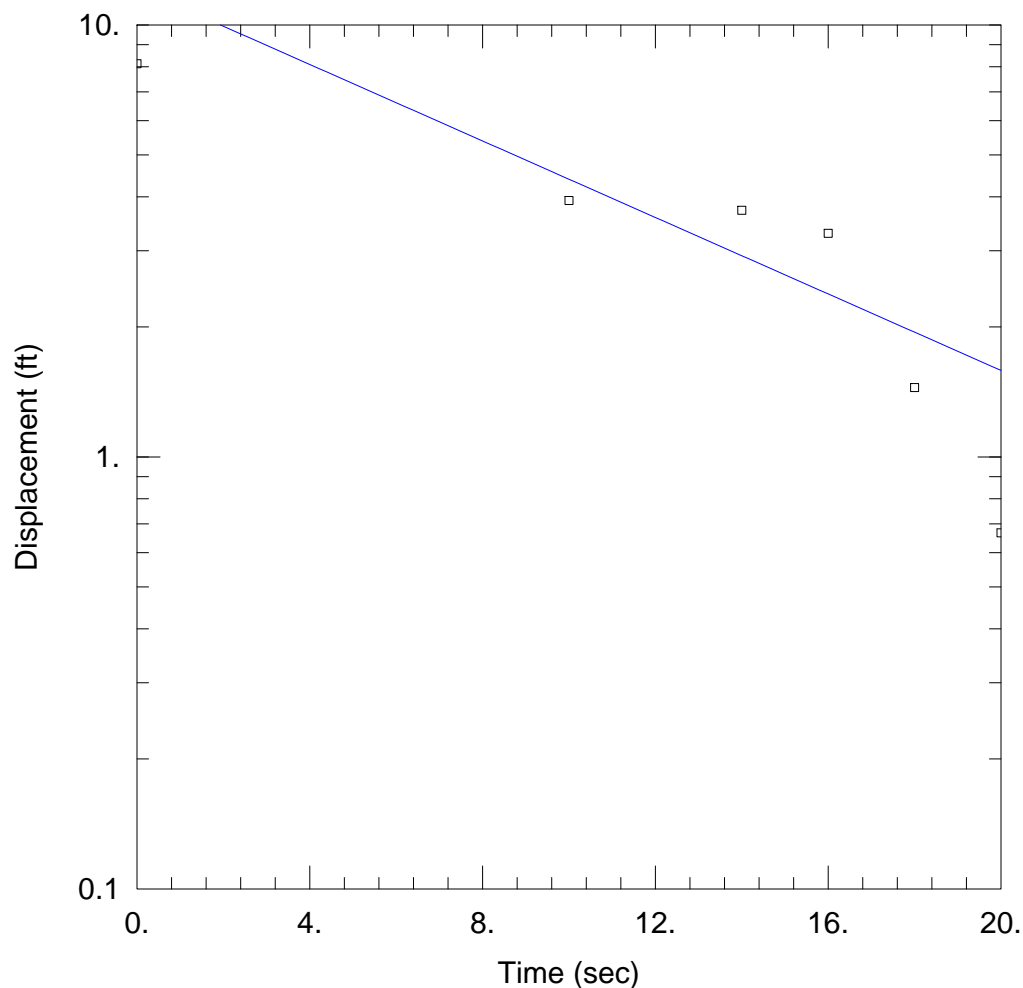
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.0001556$  ft/sec

$y_0 = 3.886$  ft



### WELL TEST ANALYSIS

Data Set: C:\Program Files (x86)\HydroSOLVE\AQTESOLV Pro 4.0\TH-2a.aqt

Date: 01/15/16

Time: 11:52:04

### PROJECT INFORMATION

Company: Thiele Geotech

Client: Griffin Dewatering

Project: 15756.00

Test Well: TH-2

Test Date: 1/8/16

### AQUIFER DATA

Saturated Thickness: 100. ft

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (TH-2)

Initial Displacement: 8.13 ft

Static Water Column Height: 100. ft

Total Well Penetration Depth: 40. ft

Screen Length: 10. ft

Casing Radius: 0.167 ft

Well Radius: 0.0833 ft

Gravel Pack Porosity: 0.

### SOLUTION

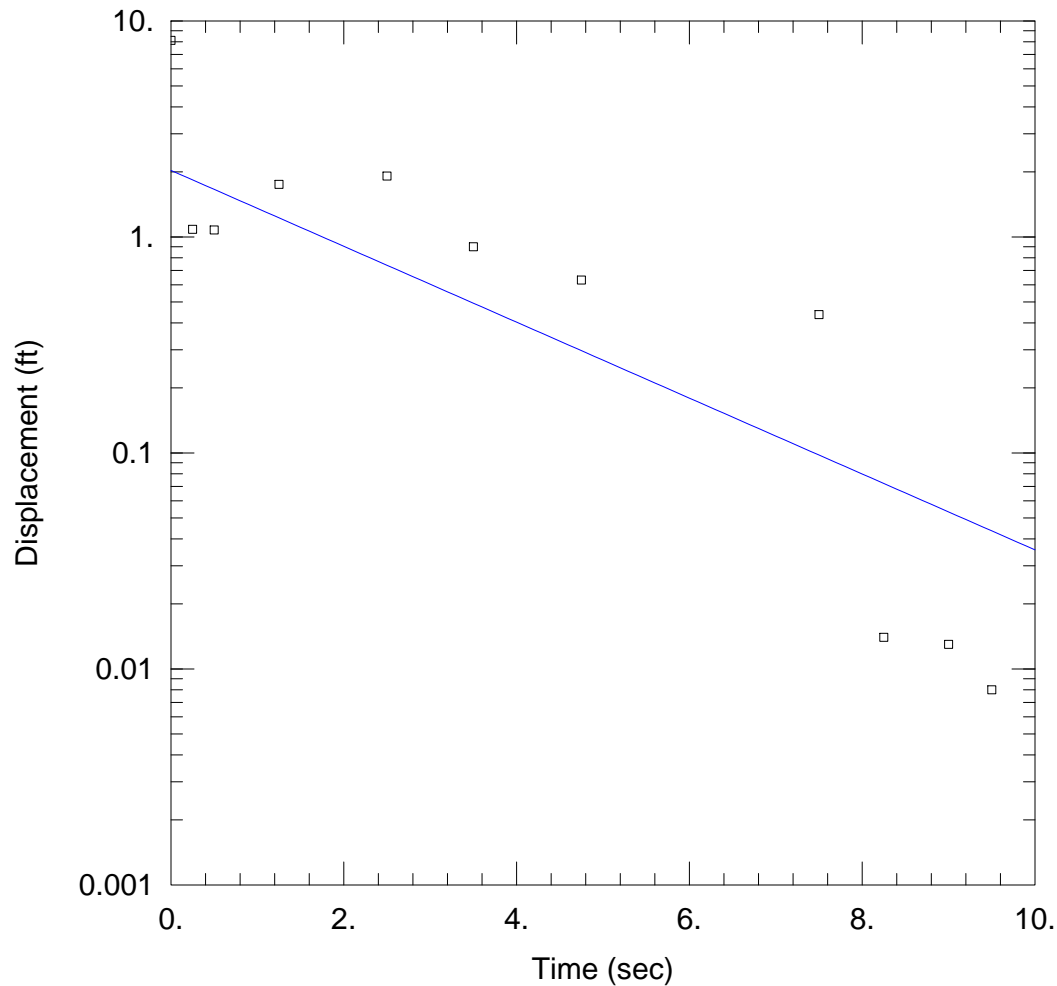
Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.0002413 ft/sec

y0 = 12.17 ft





### WELL TEST ANALYSIS

Data Set: C:\Program Files (x86)\HydroSOLVE\AQTESOLV Pro 4.0\TH-3.aqt  
 Date: 01/15/16 Time: 11:52:53

### PROJECT INFORMATION

Company: Thiele Geotech  
 Client: Griffin Dewatering  
 Project: 15756.00  
 Test Well: TH-3  
 Test Date: 1/8/16

### AQUIFER DATA

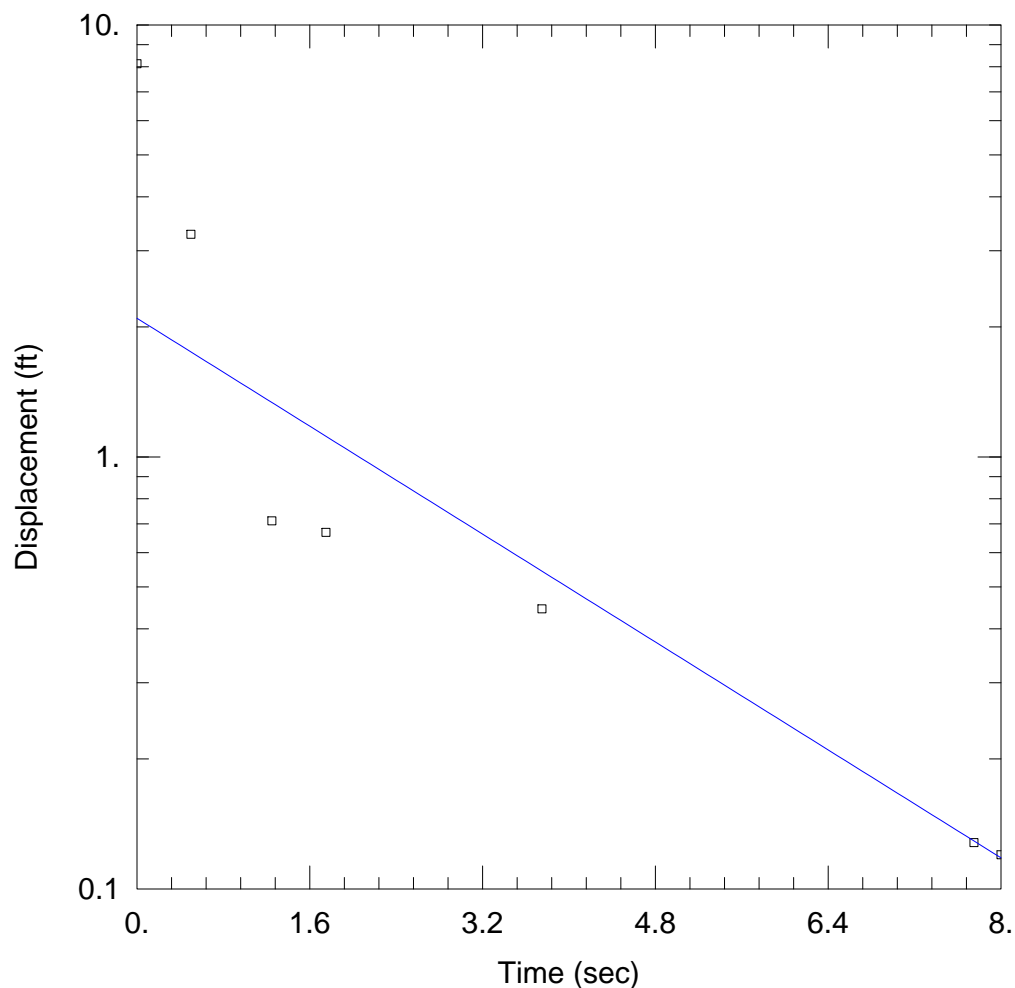
Saturated Thickness: 100. ft Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (TH-3)

Initial Displacement: 8.13 ft Static Water Column Height: 14.51 ft  
 Total Well Penetration Depth: 40. ft Screen Length: 10. ft  
 Casing Radius: 0.0833 ft Well Radius: 0.0833 ft  
 Gravel Pack Porosity: 0.

### SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice  
 $K = 0.0002368$  ft/sec  $y_0 = 2.032$  ft



### WELL TEST ANALYSIS

Data Set: C:\Program Files (x86)\HydroSOLVE\AQTESOLV Pro 4.0\TH-4.aqt

Date: 01/15/16

Time: 11:53:15

### PROJECT INFORMATION

Company: Thiele Geotech

Client: Griffin Dewatering

Project: 15756.00

Test Well: TH-4

Test Date: 1/8/16

### AQUIFER DATA

Saturated Thickness: 11.72 ft

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (TH-4)

Initial Displacement: 8.13 ft

Static Water Column Height: 100. ft

Total Well Penetration Depth: 40. ft

Screen Length: 10. ft

Casing Radius: 0.0833 ft

Well Radius: 0.0833 ft

Gravel Pack Porosity: 0.

### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.0002486$  ft/sec

$y_0 = 2.094$  ft



Thiele Geotech Inc

# BORING LOG

BOREHOLE NO.:

PH-1

TOTAL DEPTH:

40 ft.

SURFACE ELEVATION:

977 ft. MSL

PROJECT INFORMATION	DRILLING INFORMATION
<b>PROJECT: Industrial Park Levee</b> <b>SITE LOCATION: River Road, Council Bluffs, IA</b> <b>JOB NO.: 15756.00</b> <b>LOGGED BY: Seth Yakel</b> <b>PROJECT MANAGER: Kristle Beaudet</b> <b>DATE DRILLED: 12/29/2015</b>	<b>DRILLING CO.: Thiele Geotech, Inc.</b> <b>DRILLER: Brian Gappa</b> <b>RIG TYPE: CME 750</b> <b>METHOD OF DRILLING: 4.25" ID HSA</b> <b>SAMPLING METHODS: Std. SPT</b> <b>HAMMER WT./DROP: 140 lb., 30 in.</b>
NOTES:	<p>≈ Water Level During Drilling: 10 ft.</p> <p>▼ Static Water Level: 14.8 ft.</p> <p>Latitude:</p> <p>Longitude:</p>

Depth (ft.)	Sample Number	Sample Depth	Recovery (%)	SPT /ft.	PID (ppm)	Moisture	Consistency	SOIL DESCRIPTION	Soil Symbols	BORING COMPLETION	WELL DESCRIPTION	Elevation (ft. MSL)
0	S-1		N/A	1	N/A	M	VL	SM: 0-8' - Grayish brown, silty sand with trace gravel, iron and carbon staining [Fill material]			Expandable, Lockable Plug	975
				1							Surface Seal: 2' dia. concrete pad 5" thick with bentonite chips to bottom of protective casing.	
				1								
-5	S-2			2								
				1								
				2								
-10	S-3			2		VM	L	SM: 8-13' - Brown, silty sand with iron and carbon staining				
				2								
				3		W					Grout: Grout: Cement/Bentonite 6 gal. water:94 lb. cement:5 lb. bentonite powder	965
-15	S-4			3			MD	SP-SM: 13-18.5' - Brown, poorly graded sand with silt			Casing: EMI 2" nom. dia. sch. 40 PVC, flush threaded	960
				10								
				11								
-20	S-5			3				SP: 18.5-28' - Brown, poorly graded sand				
				6								
				4								
-25	S-6			4			L				Bentonite Plug: WyoBen 3/8" dia. bentonite chips	955
				4								
				5							Sand/Gravel Pack: Unimin 12/20 quartz sand	950
						VL		SM: 28-33' - Brown, silty sand				



# BORING LOG

BOREHOLE NO.: PH-1  
 TOTAL DEPTH: 40 ft.  
 SURFACE ELEVATION: 977 ft. MSL

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: <b>Industrial Park Levee</b> SITE LOCATION: <b>River Road, Council Bluffs, IA</b> JOB NO.: <b>15756.00</b> LOGGED BY: <b>Seth Yakel</b> PROJECT MANAGER: <b>Kristle Beaudet</b> DATE DRILLED: <b>12/29/2015</b>	DRILLING CO.: <b>Thiele Geotech, Inc.</b> DRILLER: <b>Brian Gappa</b> RIG TYPE: <b>CME 750</b> METHOD OF DRILLING: <b>4.25" ID HSA</b> SAMPLING METHODS: <b>Std. SPT</b> HAMMER WT./DROP: <b>140 lb., 30 in.</b>
NOTES:	∞ Water Level During Drilling: <b>10 ft.</b> ▼ Static Water Level: <b>14.8 ft.</b> Latitude: Longitude:

Depth (ft.)	Sample Number	Sample Depth	Recovery (%)	SPT /ft.	PID (ppm)	Moisture	Consistency	SOIL DESCRIPTION	Soil Symbols	BORING COMPLETION	WELL DESCRIPTION	Elevation (ft. MSL)
-30	S-7			201								
-35	S-8			5713			MD	SP-SM: 33-40' - Brown, poorly graded sand with silt			Well Screen: EMI 2" nom. dia. sch. 40 PVC, flush threaded, 0.010" milled slots	945
-40	S-9			68							Bottom Cap: EMI 2" nom. dia. sch. 40 PVC, flush	940



BOREHOLE NO.: PH-2  
TOTAL DEPTH: 40 ft.  
SURFACE ELEVATION: 977 ft. MSL

Page 1 of 2



# BORING LOG

BOREHOLE NO.: PH-2  
 TOTAL DEPTH: 40 ft.  
 SURFACE ELEVATION: 977 ft. MSL

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: <b>Industrial Park Levee</b> SITE LOCATION: <b>River Road, Council Bluffs, IA</b> JOB NO.: <b>15756.00</b> LOGGED BY: <b>Seth Yakel</b> PROJECT MANAGER: <b>Kristle Beaudet</b> DATE DRILLED: <b>12/18/2015</b>	DRILLING CO.: <b>Thiele Geotech, Inc.</b> DRILLER: <b>Daniel Morrissey</b> RIG TYPE: <b>CME 55</b> METHOD OF DRILLING: <b>4.25" ID HSA</b> SAMPLING METHODS: <b>Std. SPT</b> HAMMER WT./DROP: <b>140 lb., 30 in.</b>
NOTES:	∞ Water Level During Drilling: <b>8.5 ft.</b> ▼ Static Water Level: <b>13.5 ft.</b> Latitude: Longitude:

Depth (ft.)	Sample Number	Sample Depth	Recovery (%)	SPT /ft.	PID (ppm)	Moisture	Consistency	SOIL DESCRIPTION	Soil Symbols	BORING COMPLETION	WELL DESCRIPTION	Elevation (ft. MSL)
-30	S-8			3 3 7								
-35	S-9			8 7 5			MD	SP-SM: 33-40' - Light gray, poorly graded sand with silt			Well Screen: EMI 2" nom. dia. sch. 40 PVC, flush threaded, 0.010" milled slots	945
-40	S-10			7 7							Bottom Cap: EMI 2" nom. dia. sch. 40 PVC, flush	940



Thiele Geotech Inc

# BORING LOG

BOREHOLE NO.:

PH-3

TOTAL DEPTH:

40 ft.

SURFACE ELEVATION:

977 ft. MSL

PROJECT INFORMATION	DRILLING INFORMATION
<b>PROJECT: Industrial Park Levee</b> <b>SITE LOCATION: River Road, Council Bluffs, IA</b> <b>JOB NO.: 15756.00</b> <b>LOGGED BY: Jeremy Kendle</b> <b>PROJECT MANAGER: Kristle Beaudet</b> <b>DATE DRILLED: 12/29/2015</b>	<b>DRILLING CO.: Thiele Geotech, Inc.</b> <b>DRILLER: Daniel Morrissey</b> <b>RIG TYPE: CME 55</b> <b>METHOD OF DRILLING: 4.25" ID HSA</b> <b>SAMPLING METHODS: Std. SPT</b> <b>HAMMER WT./DROP: 140 lb., 30 in.</b>
NOTES:	≈ Water Level During Drilling: 12.5 ft. ▼ Static Water Level: 14.9 ft. Latitude: Longitude:

Depth (ft.)	Sample Number	Sample Depth	Recovery (%)	SPT /ft.	PID (ppm)	Moisture	Consistency	SOIL DESCRIPTION	Soil Symbols	BORING COMPLETION	WELL DESCRIPTION	Elevation (ft. MSL)
0	U-1		N/A		N/A	M	S	ML: 0-2' - Brown, silt with trace sand [fill material]			Expandable, Lockable Plug	975
							L	SM: 2-9' - Brown, silty sand [fill material]			Surface Seal: 2' dia. concrete pad 5" thick with bentonite chips to bottom of protective casing.	
-5	S-2		4 3 2									
-10	S-3		4 2 3				S	CL: 9-9.5' - Brown, lean clay [fill material]				
							L	SM: 9.5-12.5' - Brown, silty sand			Grout: Grout: Cement/Bentonite 6 gal. water:94 lb. cement:5 lb. bentonite powder	970
						W						
-15	S-4		3 3 6					SP: 12.5-23' - Brown, poorly graded sand			Casing: EMI 2" nom. dia. sch. 40 PVC, flush threaded	965
-20	S-5		4 5 5					trace fine gravel				960
-25	S-6		1 4 4					SP-SM: 23-28' - Gray, poorly graded sand with silt			Bentonite Plug: WyoBen 3/8" dia. bentonite chips	955
							MD	SP: 28-33' - Gray, poorly graded			Sand/Gravel Pack: Unimin 12/20 quartz sand	950



# BORING LOG

BOREHOLE NO.: **PH-3**  
 TOTAL DEPTH: **40 ft.**  
 SURFACE ELEVATION: **977 ft. MSL**

PROJECT INFORMATION	DRILLING INFORMATION
<b>PROJECT: Industrial Park Levee</b> <b>SITE LOCATION: River Road, Council Bluffs, IA</b> <b>JOB NO.: 15756.00</b> <b>LOGGED BY: Jeremy Kendle</b> <b>PROJECT MANAGER: Kristle Beaudet</b> <b>DATE DRILLED: 12/29/2015</b>	<b>DRILLING CO.: Thiele Geotech, Inc.</b> <b>DRILLER: Daniel Morrissey</b> <b>RIG TYPE: CME 55</b> <b>METHOD OF DRILLING: 4.25" ID HSA</b> <b>SAMPLING METHODS: Std. SPT</b> <b>HAMMER WT./DROP: 140 lb., 30 in.</b>
<b>NOTES:</b>	☞ Water Level During Drilling: <b>12.5 ft.</b> ▼ Static Water Level: <b>14.9 ft.</b> Latitude: Longitude:

Depth (ft.)	Sample Number	Sample Depth	Recovery (%)	SPT /ft.	PID (ppm)	Moisture	Consistency	SOIL DESCRIPTION	Soil Symbols	BORING COMPLETION	WELL DESCRIPTION	Elevation (ft. MSL)
-30	S-7			6 10 9				sand				
-35	S-8			5 10 13				SP-SM: 33-40' - Gray, poorly graded sand with silt			Well Screen: EMI 2" nom. dia. sch. 40 PVC, flush threaded, 0.010" milled slots	945
-40	S-9			8 8							Bottom Cap: EMI 2" nom. dia. sch. 40 PVC, flush	940





Thiele Geotech Inc

# BORING LOG

BOREHOLE NO.:

PH-4

TOTAL DEPTH:

39 ft.

SURFACE ELEVATION:

978 ft. MSL

PROJECT INFORMATION	DRILLING INFORMATION
<b>PROJECT: Industrial Park Levee</b> <b>SITE LOCATION: River Road, Council Bluffs, IA</b> <b>JOB NO.: 15756.00</b> <b>LOGGED BY: Jeremy Kendle</b> <b>PROJECT MANAGER:</b> <b>DATE DRILLED: 12/30/2015</b>	<b>DRILLING CO.: Thiele Geotech, Inc.</b> <b>DRILLER: Daniel Morrissey</b> <b>RIG TYPE: CME 55</b> <b>METHOD OF DRILLING: 4.25" ID HSA</b> <b>SAMPLING METHODS: Std. SPT</b> <b>HAMMER WT./DROP: 140 lb., 30 in.</b>
NOTES:	≡ Water Level During Drilling: 13.5 ft. ▼ Static Water Level: 11.8 ft. Latitude: Longitude:

Depth (ft.)	Sample Number	Sample Depth	Recovery (%)	SPT /ft.	PID (ppm)	Moisture	Consistency	SOIL DESCRIPTION	Soil Symbols	BORING COMPLETION	WELL DESCRIPTION	Elevation (ft. MSL)
0	U-1				N/A	M	F	CL: 0-8.5' - Light grayish brown, lean clay with roots, minor gravel, iron and carbon staining [fill material]			Expandable, Lockable Plug	975
	U-2							much silt, trace gravel			Surface Seal: 2' dia. concrete pad 5" thick with bentonite chips to bottom of protective casing.	
-5	U-3							minor silt				970
	U-4						L	SM: 8.5-18' - Grayish brown, silty sand			Grout: Grout: Cement/Bentonite 6 gal. water:94 lb. cement:5 lb. bentonite powder	965
-10												
	S-5			2 2 4		W					Casing: EMI 2" nom. dia. sch. 40 PVC, flush threaded	960
-15												
	S-6			2 3 5				SP-SM: 18-38' - Gray, poorly graded sand with silt				955
-20											Bentonite Plug: WyoBen 3/8" dia. bentonite chips	
	S-7			1 5 8			MD				Sand/Gravel Pack: Unimin 12/20 quartz sand	950
-25												



Thiele Geotech Inc

# BORING LOG

BOREHOLE NO.: PH-4  
TOTAL DEPTH: 39 ft.  
SURFACE ELEVATION: 978 ft. MSL

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: <b>Industrial Park Levee</b> SITE LOCATION: <b>River Road, Council Bluffs, IA</b> JOB NO.: <b>15756.00</b> LOGGED BY: <b>Jeremy Kendle</b> PROJECT MANAGER: DATE DRILLED: <b>12/30/2015</b>	DRILLING CO.: <b>Thiele Geotech, Inc.</b> DRILLER: <b>Daniel Morrissey</b> RIG TYPE: <b>CME 55</b> METHOD OF DRILLING: <b>4.25" ID HSA</b> SAMPLING METHODS: <b>Std. SPT</b> HAMMER WT./DROP: <b>140 lb., 30 in.</b>
NOTES:	☞ Water Level During Drilling: <b>13.5 ft.</b> ▼ Static Water Level: <b>11.8 ft.</b> Latitude: Longitude:

Depth (ft.)	Sample Number	Sample Depth	Recovery (%)	SPT /ft.	PID (ppm)	Moisture	Consistency	SOIL DESCRIPTION	Soil Symbols	BORING COMPLETION	WELL DESCRIPTION	Elevation (ft. MSL)
-30	S-8			3 4 5								
-35	S-9			2 8 16							Well Screen: EMI 2" nom. dia. sch. 40 PVC, flush threaded, 0.010" milled slots	945
-40	S-10			6 8				SP: 38-40' - Gray, poorly graded sand			Bottom Cap: EMI 2" nom. dia. sch. 40 PVC, flush	940



Thiele Geotech Inc

# BORING LOG

BOREHOLE NO.:

PH-5

TOTAL DEPTH:

40 ft.

SURFACE ELEVATION:

978 ft. MSL

PROJECT INFORMATION	DRILLING INFORMATION
<b>PROJECT: Industrial Park Levee</b> <b>SITE LOCATION: River Road, Council Bluffs, IA</b> <b>JOB NO.: 15756.00</b> <b>LOGGED BY: Seth Yakel</b> <b>PROJECT MANAGER: Kristle Beaudet</b> <b>DATE DRILLED: 12/30/2015</b>	<b>DRILLING CO.: Thiele Geotech, Inc.</b> <b>DRILLER: Brian Gappa</b> <b>RIG TYPE: CME 750</b> <b>METHOD OF DRILLING: 4.25" ID HSA</b> <b>SAMPLING METHODS: Std. SPT</b> <b>HAMMER WT./DROP: 140 lb., 30 in.</b>
NOTES:	≍ Water Level During Drilling: 8.5 ft. ▼ Static Water Level: 12.2 ft. Latitude: Longitude:

Depth (ft.)	Sample Number	Sample Depth	Recovery (%)	SPT /ft.	PID (ppm)	Moisture	Consistency	SOIL DESCRIPTION	Soil Symbols	BORING COMPLETION	WELL DESCRIPTION	Elevation (ft. MSL)
0	U-1				N/A	M	F	CL: 0-4.5' - Brown, lean clay with minor silt, trace gravel [fill material]			Expandable, Lockable Plug	975
								appreciable silt			Surface Seal: 2' dia. concrete pad 5" thick with bentonite chips to bottom of protective casing.	
-5	U-2						MD	SM: 4.5-6' - Gray, silty sand				
	U-3					VM		SP: 6-8.5' - Gray, poorly graded sand				970
-10	S-4		4	5		W		SP: 8.5-13' - Light brownish gray, poorly graded sand with silt			Grout: Grout: Cement/Bentonite 6 gal. water:94 lb. cement:5 lb. bentonite powder	965
			6									
-15	S-5		4	3			L	SM: 13-23' - Light brownish gray, silty sand			Casing: EMI 2" nom. dia. sch. 40 PVC, flush threaded	960
			3									
-20	S-6		4	2				gray				955
			5									
-25	S-7		3	6			MD	SP-SM: 23-40' - Gray, poorly graded sand with silt			Bentonite Plug: WyoBen 3/8" dia. bentonite chips	
			6								Sand/Gravel Pack: Unimin 12/20 quartz sand	950



Thiele Geotech Inc

# BORING LOG

BOREHOLE NO.: PH-5  
TOTAL DEPTH: 40 ft.  
SURFACE ELEVATION: 978 ft. MSL

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: <b>Industrial Park Levee</b> SITE LOCATION: <b>River Road, Council Bluffs, IA</b> JOB NO.: <b>15756.00</b> LOGGED BY: <b>Seth Yakel</b> PROJECT MANAGER: <b>Kristle Beaudet</b> DATE DRILLED: <b>12/30/2015</b>	DRILLING CO.: <b>Thiele Geotech, Inc.</b> DRILLER: <b>Brian Gappa</b> RIG TYPE: <b>CME 750</b> METHOD OF DRILLING: <b>4.25" ID HSA</b> SAMPLING METHODS: <b>Std. SPT</b> HAMMER WT./DROP: <b>140 lb., 30 in.</b>
NOTES:	☞ Water Level During Drilling: <b>8.5 ft.</b> ▼ Static Water Level: <b>12.2 ft.</b> Latitude: Longitude:

Depth (ft.)	Sample Number	Sample Depth	Recovery (%)	SPT /ft.	PID (ppm)	Moisture	Consistency	SOIL DESCRIPTION	Soil Symbols	BORING COMPLETION	WELL DESCRIPTION	Elevation (ft. MSL)
-30	S-8			4 5 5								
-35	S-9			4 7 7							Well Screen: EMI 2" nom. dia. sch. 40 PVC, flush threaded, 0.010" milled slots	945
-40	S-10			4 7							Bottom Cap: EMI 2" nom. dia. sch. 40 PVC, flush	940



Griffin Dewatering Corporation  
6414 So. 84th Street  
Omaha, NE 68127  
(402) 331-5000

Date: 1/25/2016

Rig #: 4

Contractor Judd Bros.

Driller: Dave Lane

Job Address: Council Bluffs Ia.

Helper: Clayton Juston

Branch: Omaha

Job #: SOUTH RELIEF WELL LOCATION

Depth of Hole 60'

Dia of borehole: 24"

Length of well: 17'

Dia of well: 8"

Length of screen: 36 + 5' sump

Screen Type: SS wire wrap

Well Yield: \_\_\_\_\_

Revert Used: 1-gal

Total Footage Drilled today: 60'

Water Table: 11.5'

No. of wells installed today: 1

Delays - Explain: Breaking up frozen gravel pack in shipment bags

\_\_\_\_\_

\_\_\_\_\_

Drill hole = 60' deep Set bottom of casing at 57'

well # 1 far South well

### WELL LOG

Depth	Formation	Depth	Formation
0-4	fine dry sand		
4-11.5	dark clay		
11.5- 30	very fine brown sand		
30- 35	medium to coarse clean sand		
34- 45	fine gray clean sand		
45- 55	medium to fine clean sand		
55- 57	broken gray clay lense		
57 - 60	very fine gray sand		

Dave Lane

Driller

Verified Contractor



Griffin Dewatering Corporation  
6414 So. 84th Street  
Omaha, NE 68127  
(402) 331-5000

Date: 1/27/2016

Rig #: 4

Contractor Judd Brothers

Driller: Dave L

Job Address: Council Bluffs Ia

Helper: Derek B

Ameristar

Branch: Omaha Ne.

Job #: North TEST WELL LOCATION

Depth of Hole 60'

Dia of borehole: 24"

Length of well:

Dia of well: 8"

Length of screen: 37'

Screen Type: SS - wire wrap

Well Yield:

Revert Used: 1 gal

Total Footage Drilled today: 60'

Water Table: 12'

No. of wells installed today: 1

Delays - Explain: gravel pack frozen in shipping bags

Set bottom of casing at 37'

Well 2 North end

### WELL LOG

Depth	Formation	Depth	Formation
0-2	top soil		
2-3'	gravel fill		
3-10'	gray clay		
10-12'	fine dry sand "12' water table"		
12-30'	fine brown sand		
30-34	coarse sand, trace gravel		
34-45	medium to fine sand		
45-49	coarse sand		
49-53	fine gray sand		
53-54	light gray clay lense		
54-60	fine gray sand = TD		

Dave Lane

Driller

Verified Contractor

## **APPENDIX D – INSPECTION REPORTS**

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## Inspection Report

Date \_\_\_\_\_

Inspector \_\_\_\_\_

### Type of Inspection:

☐ Routine      ☐ Periodic      ☐ After Event      ☐ Other: \_\_\_\_\_

If after the storm event, what was the precipitation? \_\_\_\_\_

If after flood event, what was the water rise? \_\_\_\_\_

### Overall System Rating

#### A. IPL

- ☐ Acceptable
- ☐ Minimally Acceptable
- ☐ Unacceptable

#### B. River Road Outfall

- ☐ Acceptable
- ☐ Minimally Acceptable
- ☐ Unacceptable

#### C. Stormwater Pump Station

- ☐ Acceptable
- ☐ Minimally Acceptable
- ☐ Unacceptable

#### D. South Stormwater Drainage Structure

- ☐ Acceptable
- ☐ Minimally Acceptable
- ☐ Unacceptable

#### E. North Stormwater Drainage Structure

- ☐ Acceptable
- ☐ Minimally Acceptable
- ☐ Unacceptable

#### F. Ameristar Boat Slip Sheet Pile Wall

- ☐ Acceptable
- ☐ Minimally Acceptable
- ☐ Unacceptable

#### G. Stemwall

- ☐ Acceptable
- ☐ Minimally Acceptable
- ☐ Unacceptable

#### H. Encroachments within Levee Prism

- ☐ Acceptable
- ☐ Minimally Acceptable
- ☐ Unacceptable

## Action Items

[illegible]

## General Instructions for the Inspection

### Purpose:

The primary purpose of these inspections is to prevent loss of life and catastrophic damages. Inspections should assure that Flood Damage Reduction structures and facilities are continually maintained and operated as necessary to obtain the maximum benefits.

### Types of Inspections:

- Routine Inspections are intended to verify proper maintenance, owner preparedness, and component operation.
- Periodic Inspections are intended to verify proper maintenance and component operation and to evaluate operational adequacy, structural stability, and safety of the system. Periodic Inspections evaluate the system's original design criteria vs. current design criteria to determine potential performance impacts, evaluate the current conditions, and compare the design loads and design analysis used against current design standards. This is to be done to identify components and features for the sponsor that need to be monitored more closely over time or corrected as needed. (Periodic Inspections are used as the basis of risk assessments.)
- After Event Inspections are intended to verify damage to the levee system or component operation as a result of a flood or major storm event. This is to be done to identify components and features that may need to be monitored more closely over time or corrected as needed prior to the next routine Inspection.

### Inspection Boundaries:

Inspections should be conducted so as to rate each Flood Damage Reduction "Segment" of the system with the levee easement. A flood damage reduction segment is defined as a discrete portion of a flood damage reduction system that is operated and maintained by a single entity. A flood damage reduction segment can be made up of one or more features (levee, floodwall, outfall locations, etc). Damages to City Infrastructure at the River Road Outfall shall be reported immediately to the City.

### Individual Item / Component Ratings:

Assessment of individual components rated during the inspection should be based on the criteria provided in the inspection report below, though inspectors may incorporate additional items into the report based on the characteristics of the system. The assessment of individual components should be based on the following definitions.

- Acceptable Item: The inspected item is in satisfactory condition, with no deficiencies, and will function as intended during the next flood event.
- Minimally Acceptable Item: The inspected item has one or more minor deficiencies that need to be corrected. The minor deficiency or deficiencies will not seriously impair the functioning of the item as intended during the next flood event.
- Unacceptable Item: The inspected item has one or more serious deficiencies that need to be corrected. The serious deficiency or deficiencies will seriously impair the functioning of the item as intended during the next flood event.

#### Overall Segment / System Ratings:

Determination of the overall system rating is based on the definitions below. Note that an Unacceptable System Rating may be either based on an engineering determination that concluded that noted deficiencies would prevent the system from functioning as intended during the next flood event, or based on a demonstrated lack of commitment or inability to correct serious deficiencies in a timely manner.

- **Acceptable System:** All items or components are rated as Acceptable.
- **Minimally Acceptable System:** One or more items are rated as Minimally Acceptable or one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable items would not prevent the segment / system from performing as intended during the next flood event.
- **Unacceptable System:** One or more items are rated as Unacceptable and would prevent the segment / system from performing as intended, or a serious deficiency noted in past inspections (which had previously resulted in a minimally acceptable system rating) has not been corrected within the established timeframe, not to exceed two years.

#### Reporting:

After the inspection, the inspector is responsible for assembling an inspection report (or a summary report if it was a Periodic Inspection) including the following information:

- All sections of the report template used during the inspection, including the cover and pre-inspection materials. (Supplemental data collected, and any sections of the template that weren't used during the inspection do not need to be included with the report.)
- Photos of the general system condition and noted deficiencies.
- A plan view drawing of the system, with stationing, to reference locations of items rated less than acceptable.
- The relative importance of the identified maintenance issues should be specified in the transmittal letter.

If the Overall System Rating is Minimally Acceptable, the report needs to establish a timeframe for correction of serious deficiencies noted (not to exceed two years).

#### Notification:

Reports are to be disseminated as follows within 30 days of the inspection date.

- If the Overall System Rating is Acceptable reports need to be provided to the local sponsor and owners.
- If the Overall System Rating is Minimally Acceptable reports need to be provided to the local sponsor, owners, state emergency management agency, and county emergency management agency.
- If the Overall System Rating is Unacceptable reports need to be provided to the local sponsor, owners, state emergency management agency, county emergency management agency, FEMA region.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
<b>IPL General</b>			
1. Unwanted Vegetation Growth		<b>A</b> The levee has a good grass cover with little or no unwanted vegetation (trees, bushes, or undesirable weeds) and has been recently mowed. Additionally, a 15' vegetation free zone is maintained to protect the external limits of the levee cross section.	
		<b>M</b> Minimal number of trees (2" diameter or smaller) and /or brush present on the levee or within the 15' zone, that will not threaten the integrity of the project but which need to be removed.	
		<b>U</b> Significant vegetation growth (brush, weeds, or any trees greater than 2 inches in diameter) is present within the zones described above and must to be removed to reestablish or ascertain levee integrity	
2. Sod Cover		<b>A</b> There is good coverage of sod over the levee.	
		<b>M</b> Approximately 25% of the sod cover is missing or damaged over a significant portion or over significant portions of the levee embankment. This may be the result of over-grazing or feeding on the levee, unauthorized vehicular traffic, chemical or insect problems, or burning during inappropriate seasons.	
		<b>U</b> Over 50% of sod cover is missing or damaged over a significant portion or portions of the levee embankment	
3. Encroachment		<b>A</b> No trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by a qualified Engineer, and it was determined that they do not diminish proper functioning of the levee.	
		<b>M</b> Trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by a qualified Engineer.	
		<b>U</b> Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the levee.	
4. Slope Stability		<b>A</b> No slides, sloughs, tension cracking, slope depressions, or bulges are present.	
		<b>M</b> Minor slope stability problems that do not pose an immediate threat to the levee embankment.	
		<b>U</b> Surficial instabilities that require more than typical or periodic repair and that threatens levee integrity.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
5. Internal Slope Stability		<b>A</b> A professional familiar with levee stability has determined that no slides are present.	
		<b>M</b> Signs of deep seated instability cannot be determined from site assessment.	
		<b>U</b> Evidence of deep seated sliding that threatens levee integrity that requires repairs.	
6. Erosion/ Bank Caving		<b>A</b> No active erosion or undermining observed on the landward or on the riverward side of the levee.	
		<b>M</b> There are areas where active erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
		<b>U</b> Erosion, undermining, or caving is occurring or has occurred along the toes that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
7. Settlement		<b>A</b> No observed depressions in crown. Records exist and indicate no unexplained historical changes.	
		<b>M</b> Minor irregularities that do not threaten integrity of levee. Records are incomplete or inclusive	
		<b>U</b> Obvious variations in elevation over significant reaches. No records exist or records indicate that design elevation is compromised	
8. Depression/ Rutting		<b>A</b> There are no ruts, pot holes, or other depressions on the levee. No evidence of levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without any ponded water.	
		<b>M</b> Some minor depressions in the levee crown, embankment, or access roads that will not threaten the integrity of the levee.	
		<b>U</b> There are depressions or ruts greater than 6 inches deep that could threaten levee integrity.	
9. Animal Burrows		<b>A</b> No animal burrows present on the levees.	
		<b>M</b> There is evidence of animal burrowing, however, disturbances are shallow and would not threaten levee integrity during a flood.	
		<b>U</b> There are burrows present which extend into the levee embankment or are in close proximity to the land side toe of embankment. Immediate maintenance is required to fill existing burrows to restore levee integrity.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
10. Riprap		<b>A</b> Existing riprap is properly maintained and is undamaged. The rip rap is not displaced, of sound quality and no scour occurred.	
		<b>M</b> No or minimal rip rap displacement or scouring activity that could undercut banks, erode embankments, or restrict desired flow.	
		<b>U</b> Meandering and/or scour activity is undercutting banks, significant amount of riprap is displaced, eroding embankments, or impairing flows by causing turbulence.	
11. Warren Toe Drainage Systems		<b>A</b> Toe drainage systems necessary for maintaining segment / system stability during high water functioned properly during the last flood event and no sediment is observed in horizontal system. Nothing is observed which would indicate that the drainage systems won't function properly during the next flood, and maintenance records indicate regular cleaning.	
		<b>M</b> Toe drainage systems is damaged and may become clogged if not repaired. Maintenance records are incomplete or indicate irregular cleaning.	
		<b>U</b> Toe drainage systems necessary for maintaining segment / system stability during flood events have fallen into disrepair or have become clogged. No maintenance records.	
12. Slab Drainage Systems Ameristar Under		<b>A</b> Under slab drainage system necessary for maintaining segment / system stability during high water functioned properly during the last flood event and no sediment is observed in horizontal system. Nothing is observed which would indicate that the drainage systems won't function properly during the next flood, and maintenance records indicate sump pumps are working properly.	
		<b>M</b> Under slab drainage system is damaged and may become clogged if they are not repaired. Sump pumps are not working but emergency pumps are available if needed.	
		<b>U</b> Under slab drainage systems has fallen into disrepair or have become clogged. Sump pumps are not working and emergency backup pumps are not available.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
Ameristar Relief 13. Wells/Piezometer Well Systems		<b>A</b> Pressure relief wells necessary for maintaining segment / system stability during high water functioned properly during the last flood event. Nothing is observed which would indicate that the well systems won't function properly during the next flood and outlets are free of debris. Wells have been pumped tested within the past 5 years and documentation is provided. Piezometers metal flush mount covers and PVC pipe caps are present.	
		<b>M</b> Pressure relief wells are damaged and may become clogged if they are not repaired. Maintenance records are incomplete or indicate irregular pump testing. Piezometer well covers are missing or damaged.	
		<b>U</b> Pressure relief wells necessary for maintaining segment / system stability during flood events have fallen into disrepair or have become clogged. No documentation of the required pump testing.	
Cargill Relief 14. Wells/Piezometer Well Systems		<b>A</b> Pressure relief wells necessary for maintaining segment / system stability during high water functioned properly during the last flood event. Nothing is observed which would indicate that the well systems won't function properly during the next flood and outlets are free of debris. Wells have been pumped tested within the past 5 years and documentation is provided. Piezometers metal flush mount covers and PVC pipe caps are present.	
		<b>M</b> Pressure relief wells are damaged and may become clogged if they are not repaired. Maintenance records are incomplete or indicate irregular pump testing. Piezometer well covers are missing or damaged.	
		<b>U</b> Pressure relief wells necessary for maintaining segment / system stability during flood events have fallen into disrepair or have become clogged. No documentation of the required pump testing.	
15. Seepage		<b>A</b> No evidence or history of unrepaired seepage, saturated areas, or boils.	
		<b>M</b> Evidence or history of minor unrepaired seepage or small saturated areas at or beyond the landside toe but not on the landward slope of levee. No evidence of soil transport	
		<b>U</b> Evidence or history of active seepage, extensive saturated areas, or boils.	
16. Deviation from As-Built Plans		<b>A</b> There are no deviations from the as-built plans.	
		<b>M</b> There are minor deviations from the as-built plans that would not affect the functionality of the levee.	
		<b>U</b> There are major deviations from the as-built plans that could affect the functionality of the levee. Additional engineering analyses are recommended.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.



Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
<b>Warren Outfall Stormwater Drainage Structure (STA 214 + 50)</b>			
1. Flap Gate		<b>A</b> Flap gate opens and closes easily with minimal leakage. Gate shows no corrosion and has been maintained.	
		<b>M</b> Gate will not fully open or close due to obstructions that can be easily removed, or has corrosion damage that requires maintenance.	
		<b>U</b> Gate is missing, has been damaged, or has deteriorated and needs repair.	
2. Concrete Surfaces		<b>A</b> Negligible spalling, scaling or cracking. If the concrete surface is weathered, rough to the touch, or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	
		<b>M</b> Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/scaling is necessary to prevent additional damage during periods of freezing and thawing.	
		<b>U</b> Surface deterioration or deep, controlled cracks are present that result in an unreliable structure.	
3. Foundation of Concrete Structures		<b>A</b> No scouring, erosion, or undermining is occurring near the structure.	
		<b>M</b> Scouring or erosion is occurring near the footing of the structure, but is not close enough to affect the structure stability during the next flood.	
		<b>U</b> Scouring or undermining at the foundation of the structure has affected the structural integrity.	
4. Sluice Gates		<b>A</b> Gates open and close freely with minor leakage. Sill is free of sediment and other obstructions. Gates and lifters have been maintained.	
		<b>M</b> Gates have been damaged or have deteriorated, and open and close with resistance or binding. Leakage quantity is controllable and is not a threat to project performance. Maintenance is required.	
		<b>U</b> Gates do not open or close. Gate, stem, lifter and/or guides may be damaged or corroded.	
5. Operators for Sluice Gates		<b>A</b> All manual operators are in good working condition and are capable of opening and closing the gate properly. Preventative maintenance is being performed and the system is tested periodically.	
		<b>M</b> Manual gate operators are operational with minor deficiencies, but should perform through the next period of usage.	
		<b>U</b> Manual gate operators are not operational.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
6. Erosion of Inlet/ Discharge Areas		<b>A</b> No active erosion or bank caving observed on the landward or on the riverward side of the levee.	
		<b>M</b> There are areas where active erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
		<b>U</b> Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
7. Blockage of Culverts		<b>A</b> There is little to no debris, sediment, or vegetation blocking the culverts, inlets, or discharge areas. The channel capacity for designed flow is not affected.	
		<b>M</b> Debris, sediment, or vegetation blocks less than 10 percent of the culvert opening, but must be removed.	
		<b>U</b> Accumulated debris, sediment, or vegetation blocks more than 10 percent of the culvert opening, impairing the culvert's capacity and hydraulic effectiveness.	
8. Culverts		<b>A</b> There are no breaks, holes, cracks in the culvert that would result in significant water leakage.	
		<b>M</b> There are breaks, holes, cracks in the culvert that would result in water leakage and need to be repaired, but do not threaten the integrity of the project.	
		<b>U</b> Culvert has deterioration and/or has significant leakage such that it threatens the integrity of the levee.	
9. Riprap revetments of inlet/discharge areas		<b>A</b> Existing riprap protection is properly maintained and is undamaged. Riprap clearly visible.	
		<b>M</b> No riprap displacement or scouring activity that could undercut banks, erode embankments, or restrict desired flow. Unwanted vegetation must be cleared and sprayed with an appropriate herbicide.	
		<b>U</b> Dense brush, trees, or grasses hide the rock protection, or meandering and/or scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling..	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
<b>Cargill Outfall Stormwater Drainage Structure (STA 222+10)</b>			
1. Flap Gate		<b>A</b> Flap gate opens and closes easily with minimal leakage. Gate shows no corrosion and has been maintained.	
		<b>M</b> Gate will not fully open or close due to obstructions that can be easily removed, or has corrosion damage that requires maintenance.	
		<b>U</b> Gate is missing, has been damaged, or has deteriorated and needs repair.	
2. Concrete Surfaces		<b>A</b> Negligible spalling, scaling or cracking. If the concrete surface is weathered, rough to the touch, or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	
		<b>M</b> Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/scaling is necessary to prevent additional damage during periods of freezing and thawing.	
		<b>U</b> Surface deterioration or deep, controlled cracks are present that result in an unreliable structure.	
3. Foundation of Concrete Structures		<b>A</b> No scouring, erosion, or undermining is occurring near the structure.	
		<b>M</b> Scouring or erosion is occurring near the footing of the structure, but is not close enough to affect the structure stability during the next flood.	
		<b>U</b> Scouring or undermining at the foundation of the structure has affected the structural integrity.	
4. Sluice Gates		<b>A</b> Gates open and close freely with minor leakage. Sill is free of sediment and other obstructions. Gates and lifters have been maintained.	
		<b>M</b> Gates have been damaged or have deteriorated, and open and close with resistance or binding. Leakage quantity is controllable and is not a threat to project performance. Maintenance is required.	
		<b>U</b> Gates do not open or close. Gate, stem, lifter and/or guides may be damaged or corroded.	
5. Operators for Sluice Gates		<b>A</b> All manual operators are in good working condition and are capable of opening and closing the gate properly. Preventative maintenance is being performed and the system is tested periodically.	
		<b>M</b> Manual gate operators are operational with minor deficiencies, but should perform through the next period of usage.	
		<b>U</b> Manual gate operators are not operational.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
6. Erosion of Inlet/ Discharge Areas		<b>A</b> No active erosion or bank caving observed on the landward or on the riverward side of the levee.	
		<b>M</b> There are areas where active erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
		<b>U</b> Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
7. Blockage of Culverts		<b>A</b> There is little to no debris, sediment, or vegetation blocking the culverts, inlets, or discharge areas. The channel capacity for designed flow is not affected.	
		<b>M</b> Debris, sediment, or vegetation blocks less than 10 percent of the culvert opening, but must be removed.	
		<b>U</b> Accumulated debris, sediment, or vegetation blocks more than 10 percent of the culvert opening, impairing the culvert's capacity and hydraulic effectiveness.	
8. Culverts		<b>A</b> There are no breaks, holes, cracks in the culvert that would result in significant water leakage.	
		<b>M</b> There are breaks, holes, cracks in the culvert that would result in water leakage and need to be repaired, but do not threaten the integrity of the project.	
		<b>U</b> Culvert has deterioration and/or has significant leakage such that it threatens the integrity of the levee.	
9. Riprap revetments of inlet/discharge areas		<b>A</b> Existing riprap protection is properly maintained and is undamaged. Riprap clearly visible.	
		<b>M</b> No riprap displacement or scouring activity that could undercut banks, erode embankments, or restrict desired flow. Unwanted vegetation must be cleared and sprayed with an appropriate herbicide.	
		<b>U</b> Dense brush, trees, or grasses hide the rock protection, or meandering and/or scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
<b>River Road Outfall</b>			
1. Flap Gate		<b>A</b> Flap gate opens and closes easily with minimal leakage. Gate shows no corrosion and has been maintained.	
		<b>M</b> Gate will not fully open or close due to obstructions that can be easily removed, or has corrosion damage that requires maintenance.	
		<b>U</b> Gate is missing, has been damaged, or has deteriorated and needs repair.	
2. Concrete Surfaces		<b>A</b> Negligible spalling, scaling or cracking. If the concrete surface is weathered, rough to the touch, or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	
		<b>M</b> Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/scaling is necessary to prevent additional damage during periods of freezing and thawing.	
		<b>U</b> Surface deterioration or deep, controlled cracks are present that result in an unreliable structure.	
3. Foundation of Concrete Structures		<b>A</b> No scouring, erosion, or undermining is occurring near the structure.	
		<b>M</b> Scouring or erosion is occurring near the footing of the structure, but is not close enough to affect the structure stability during the next flood.	
		<b>U</b> Scouring or undermining at the foundation of the structure has affected the structural integrity.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
<b>Ameristar Outfall and Storm Water Pump Station (STA 235 + 90)</b>			
1. Pump Station Operating Log		<b>A</b> Operation and maintenance log is present at the pump station and is being used and updated, and personnel have been trained to pump station operations. Names and last training date shown in the log book.	
		<b>U</b> No operating log present, or refresher training for personnel has not been conducted.	
2. Pump Station Operation and Maintenance Manual		<b>A</b> Operation and maintenance manual and/or posted operating instructions are present and adequately cover all pertinent pump station features.	
		<b>U</b> Operation and maintenance manual missing or sponsor is unsure of location.	
3. Pumps		<b>A</b> All pumps are properly maintained and lubricated. Systems are periodically tested, and there is no evidence of cavitation, vibrations, or unusual sounds.	
		<b>M</b> Minor deficiencies exist which need to be closely monitored or repaired, such as the presence of minor vibrations or the corrosion of the pump shaft housing. However, the pumps are operational and are expected to perform through the next period of usage or there is a reliable backup pumping plan in place.	
		<b>U</b> Multiple pumps are not operational, or the pump capacity has degraded to the point where project performance is in question and there is not a reliable backup pumping plan in place.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
4. Power		<b>A</b> The power source is adequate, safe, and reliable. Backup generators are on hand or there is a reliable backup power plan in place. Backup units are properly sized, operational, periodically exercised, and properly maintained.	
		<b>U</b> Power source not considered safe or reliable to sustain operations during flood conditions.	
5. Sumps/ Wet Well		<b>A</b> Clear of excessive debris, sediment, or other obstructions. Procedures are in place to remove debris accumulation during operation.	
		<b>M</b> Debris, sediment, or other obstructions are present and must be removed, but the sump/ wet well will function as intended during the next flood. Procedures are in place to remove debris accumulation during operation.	
		<b>U</b> Large debris or excessive silt present which will hinder or damage pumps during operation, or no procedures have been established to remove debris accumulation during operation.	
6. Sluice Gates		<b>A</b> Gates open and close freely with minor leakage. Sill is free of sediment and other obstructions. Gates and lifters have been maintained.	
		<b>M</b> Gates have been damaged or have deteriorated, and open and close with resistance or binding. Leakage quantity is controllable and is not a threat to project performance. Maintenance is required.	
		<b>U</b> Gates do not open or close. Gate, stem, lifter and/or guides may be damaged or corroded.	
7. Operators for Sluice Gates		<b>A</b> All manual operators are in good working condition and are capable of opening and closing the gate properly. Preventative maintenance is being performed and the system is tested periodically.	
		<b>M</b> Manual gate operators are operational with minor deficiencies, but should perform through the next period of usage.	
		<b>U</b> Manual gate operators are not operational.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
Equipment, 8. Ladders, Anchors, etc.		<b>A</b> All metal parts are protected from corrosion damage, and show no rust, damage, or deterioration that would cause a safety concern.	
		<b>M</b> Corrosion seen on metallic parts appear to be maintainable.	
		<b>U</b> Metallic parts are severely corroded and require replacement to prevent failure, equipment damage, or safety issues.	
9. Flap Gate		<b>A</b> Flap gate opens and closes easily with minimal leakage. Gate shows no corrosion and has been maintained.	
		<b>M</b> Gate will not fully open or close due to obstructions that can be easily removed, or has corrosion damage that requires maintenance.	
		<b>U</b> Gate is missing, has been damaged, or has deteriorated and needs repair.	
10. Concrete Surfaces		<b>A</b> Negligible spalling, scaling or cracking. If the concrete surface is weathered, rough to the touch, or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	
		<b>M</b> Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/scaling is necessary to prevent additional damage during periods of freezing and thawing.	
		<b>U</b> Surface deterioration or deep, controlled cracks are present that result in an unreliable structure.	
11. Foundation of Concrete Structures		<b>A</b> No scouring, erosion, or undermining is occurring near the structure.	
		<b>M</b> Scouring or erosion is occurring near the footing of the structure, but is not close enough to affect the structure stability during the next flood.	
		<b>U</b> Scouring or undermining at the foundation of the structure has affected the structural integrity.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.



Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
12. Erosion of Inlet/ Discharge Areas		<b>A</b> No active erosion or bank caving observed on the landward or on the riverward side of the levee.	
		<b>M</b> There are areas where active erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
		<b>U</b> Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
13. Blockage of Culverts		<b>A</b> There is little to no debris, sediment, or vegetation blocking the culverts, or discharge areas.	
		<b>M</b> Debris, sediment, or vegetation blocks less than 10 percent of the culvert opening, but must be removed.	
		<b>U</b> Accumulated debris, sediment, or vegetation blocks more than 10 percent of the culvert opening, impairing the culvert's capacity and hydraulic effectiveness.	
14. Culverts		<b>A</b> There are no breaks, holes, cracks in the culvert that would result in significant water leakage.	
		<b>M</b> There are breaks, holes, cracks in the culvert that would result in water leakage and need to be repaired, but do not threaten the integrity of the project.	
		<b>U</b> Culvert has deterioration and/or has significant leakage such that it threatens the integrity of the levee.	
Riprap revetments 15. of inlet/discharge areas		<b>A</b> Existing riprap protection is properly maintained and is undamaged. Riprap clearly visible.	
		<b>M</b> No riprap displacement or scouring activity that could undercut banks, erode embankments, or restrict desired flow. Unwanted vegetation must be cleared and sprayed with an appropriate herbicide.	
		<b>U</b> Dense brush, trees, or grasses hide the rock protection, or meandering and/or scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling..	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
<b>Ameristar Roof Drain South (241+12)</b>			
1. Flap Gate		<b>A</b> Flap gate opens and closes easily with minimal leakage. Gate shows no corrosion and has been maintained.	
		<b>M</b> Gate will not fully open or close due to obstructions that can be easily removed, or has corrosion damage that requires maintenance.	
		<b>U</b> Gate is missing, has been damaged, or has deteriorated and needs repair.	
2. Concrete Surfaces		<b>A</b> Negligible spalling, scaling or cracking. If the concrete surface is weathered, rough to the touch, or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	
		<b>M</b> Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/scaling is necessary to prevent additional damage during periods of freezing and thawing.	
		<b>U</b> Surface deterioration or deep, controlled cracks are present that result in an unreliable structure.	
3. Foundation of Concrete Structures		<b>A</b> No scouring, erosion, or undermining is occurring near the structure.	
		<b>M</b> Scouring or erosion is occurring near the footing of the structure, but is not close enough to affect the structure stability during the next flood.	
		<b>U</b> Scouring or undermining at the foundation of the structure has affected the structural integrity.	
4. Sluice Gates		<b>A</b> Gates open and close freely with minor leakage. Sill is free of sediment and other obstructions. Gates and lifters have been maintained.	
		<b>M</b> Gates have been damaged or have deteriorated, and open and close with resistance or binding. Leakage quantity is controllable and is not a threat to project performance. Maintenance is required.	
		<b>U</b> Gates do not open or close. Gate, stem, lifter and/or guides may be damaged or corroded.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
5. Operators for Sluice Gates		<b>A</b> All manual operators are in good working condition and are capable of opening and closing the gate properly. Preventative maintenance is being performed and the system is tested periodically.	
		<b>M</b> Manual gate operators are operational with minor deficiencies, but should perform through the next period of usage.	
		<b>U</b> Manual gate operators are not operational.	
6. Erosion of Inlet/ Discharge Areas		<b>A</b> No active erosion or bank caving observed on the landward or on the riverward side of the levee.	
		<b>M</b> There are areas where active erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
		<b>U</b> Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
7. Blockage of Culverts		<b>A</b> There is little to no debris, sediment, or vegetation blocking the culverts, inlets, or discharge areas. The channel capacity for designed flow is not affected.	
		<b>M</b> Debris, sediment, or vegetation blocks less than 10 percent of the culvert opening, but must be removed.	
		<b>U</b> Accumulated debris, sediment, or vegetation blocks more than 10 percent of the culvert opening, impairing the culvert's capacity and hydraulic effectiveness.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
8. Culverts		<b>A</b> There are no breaks, holes, cracks in the culvert that would result in significant water leakage.	
		<b>M</b> There are breaks, holes, cracks in the culvert that would result in water leakage and need to be repaired, but do not threaten the integrity of the project.	
		<b>U</b> Culvert has deterioration and/or has significant leakage such that it threatens the integrity of the levee.	
Riprap revetments 9. of inlet/discharge areas		<b>A</b> Existing riprap protection is properly maintained and is undamaged. Riprap clearly visible.	
		<b>M</b> No riprap displacement or scouring activity that could undercut banks, erode embankments, or restrict desired flow. Unwanted vegetation must be cleared and sprayed with an appropriate herbicide.	
		<b>U</b> Dense brush, trees, or grasses hide the rock protection, or meandering and/or scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
<b>Ameristar Roof Drain North (244+25)</b>			
1. Flap Gate		<b>A</b> Flap gate opens and closes easily with minimal leakage. Gate shows no corrosion and has been maintained.	
		<b>M</b> Gate will not fully open or close due to obstructions that can be easily removed, or has corrosion damage that requires maintenance.	
		<b>U</b> Gate is missing, has been damaged, or has deteriorated and needs repair.	
2. Concrete Surfaces		<b>A</b> Negligible spalling, scaling or cracking. If the concrete surface is weathered, rough to the touch, or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	
		<b>M</b> Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/scaling is necessary to prevent additional damage during periods of freezing and thawing.	
		<b>U</b> Surface deterioration or deep, controlled cracks are present that result in an unreliable structure.	
3. Foundation of Concrete Structures		<b>A</b> No scouring, erosion, or undermining is occurring near the structure.	
		<b>M</b> Scouring or erosion is occurring near the footing of the structure, but is not close enough to affect the structure stability during the next flood.	
		<b>U</b> Scouring or undermining at the foundation of the structure has affected the structural integrity.	
4. Sluice Gates		<b>A</b> Gates open and close freely with minor leakage. Sill is free of sediment and other obstructions. Gates and lifters have been maintained.	
		<b>M</b> Gates have been damaged or have deteriorated, and open and close with resistance or binding. Leakage quantity is controllable and is not a threat to project performance. Maintenance is required.	
		<b>U</b> Gates do not open or close. Gate, stem, lifter and/or guides may be damaged or corroded.	
5. Operators for Sluice Gates		<b>A</b> All manual operators are in good working condition and are capable of opening and closing the gate properly. Preventative maintenance is being performed and the system is tested periodically.	
		<b>M</b> Manual gate operators are operational with minor deficiencies, but should perform through the next period of usage.	
		<b>U</b> Manual gate operators are not operational.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
6. Erosion of Inlet/ Discharge Areas		<b>A</b> No active erosion or bank caving observed on the landward or on the riverward side of the levee.	
		<b>M</b> There are areas where active erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
		<b>U</b> Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
7. Blockage of Culverts		<b>A</b> There is little to no debris, sediment, or vegetation blocking the culverts, inlets, or discharge areas. The channel capacity for designed flow is not affected.	
		<b>M</b> Debris, sediment, or vegetation blocks less than 10 percent of the culvert opening, but must be removed.	
		<b>U</b> Accumulated debris, sediment, or vegetation blocks more than 10 percent of the culvert opening, impairing the culvert's capacity and hydraulic effectiveness.	
8. Culverts		<b>A</b> There are no breaks, holes, cracks in the culvert that would result in significant water leakage.	
		<b>M</b> There are breaks, holes, cracks in the culvert that would result in water leakage and need to be repaired, but do not threaten the integrity of the project.	
		<b>U</b> Culvert has deterioration and/or has significant leakage such that it threatens the integrity of the levee.	
9. Riprap revetments of inlet/discharge areas		<b>A</b> Existing riprap protection is properly maintained and is undamaged. Riprap clearly visible.	
		<b>M</b> No riprap displacement or scouring activity that could undercut banks, erode embankments, or restrict desired flow. Unwanted vegetation must be cleared and sprayed with an appropriate herbicide.	
		<b>U</b> Dense brush, trees, or grasses hide the rock protection, or meandering and/or scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
<b>Stemwall</b>			
1. Unwanted Vegetation Growth		<b>A</b> A grass-only or paved zone is maintained on the landward side of the floodwall, free of all trees, brush, and undesirable weeds. The vegetation-free zone extends 15 feet from both the land and riverside of the floodwall, at ground-level, to the centerline of the tree. Additionally, an 8-foot root-free zone is maintained around the entire structure, including the floodwall toe, heel, and any toe-drains. If the floodwall access easement doesn't extend to the described limits, then the vegetation-free zone must be maintained to the easement limits.	
		<b>M</b> Minimal vegetation growth (brush, weeds, or trees 2 inches in diameter or smaller) is present within the zones described above. This vegetation must be removed but does not currently threaten the operation or integrity of the floodwall.	
		<b>U</b> Significant vegetation growth (brush, weeds, or any trees greater than 2 inches in diameter) is present within the zones described above. This vegetation threatens the operation or integrity of the floodwall and must be removed.	
2. Encroachments		<b>A</b> No trash, debris, unauthorized structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the a qualified engineer, and it was determined that they do not diminish proper <u>functioning of the floodwall</u> .	
		<b>M</b> Trash, debris, unauthorized structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by a <u>qualified engineer</u> .	
		<b>U</b> Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the floodwall.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
4. Concrete Surfaces		<b>A</b> Negligible spalling, scaling or cracking. If the concrete surface is weathered or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/thaw damage.	
		<b>M</b> Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/ sealing is necessary to prevent additional damage during periods of thawing and freezing.	
		<b>U</b> Surface deterioration or deep cracks present that may result in an unreliable structure. Any surface deterioration that exposes the sheet piling or lies adjacent to monolith joints may indicate underlying reinforcement corrosion and is unacceptable.	
Tilting, Sliding or 5. Settlement of Concrete Structures		<b>A</b> There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure	
		<b>M</b> There are areas of tilting, sliding, or settlement (either active or inactive) that need to be repaired. The maximum offset, either laterally or vertically, does not exceed 2 inches unless the movement can be shown to be no longer actively occurring. The integrity of the structure is not in danger.	
		<b>U</b> There are areas of tilting, sliding, or settlement (either active or inactive) that threaten the structure's integrity and performance. Any movement that has resulted in failure of the waterstop (possibly identified by daylight visible through the joint) is unacceptable. Differential movement of greater than 2 inches between any two adjacent wall section, either laterally or vertically, is unacceptable unless it can be shown that the movement is no longer active. Any visible or measurable tilting of the wall toward the protected side that has created an open horizontal crack on the riverside of the wall is unacceptable.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.



Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
6. Foundation of Concrete Structures		<b>A</b> No active erosion, scouring, or bank caving that might endanger the structure's stability.	
		<b>M</b> There are areas where the ground is eroding towards the base of the structure. Efforts need to be taken to slow and repair this erosion, but it is not judged to be close enough to the structure or to be progressing rapidly enough to affect structural stability before the next inspection. For the purposes of inspection, the erosion or scour is not closer to the riverside face of the wall than twice the floodwall's underground base width if the wall is of L-wall or T-wall construction; or if the wall is of sheetpile or I-wall construction, the erosion is not closer than twice the wall's visible height. Additionally, rate of erosion is such that the wall is expected to remain stable until the next inspection.	
		<b>U</b> Erosion or bank caving observed that is closer to the wall than the limits described above, or is outside these limits but may lead to structural instabilities before the next inspection. The foundation is unacceptable if any turf, soil or pavement material got washed away from the landside of the I-wall as the result of a previous overtopping event.	
7. Joints		<b>A</b> The joint material is in good condition. The exterior joint sealant is intact and cracking/ desiccation is minimal. Joint filler material and/or waterstop is not visible at any point.	
		<b>M</b> The joint material has appreciable deterioration to the point where joint filler material and/or waterstop is visible in some locations. This needs to be repaired or replaced to prevent spalling and cracking during freeze/ thaw cycles, and to ensure <u>water tightness of the joint</u> .	
		<b>U</b> The joint material is severely deteriorated or the concrete adjacent to the monolith joints has spalled and cracked, damaging the waterstop; in either case damage has occurred to the point where it is apparent that the joint is no longer watertight and will not provide the intended level of protection during a flood.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
<b>Ameristar Boat Slip Sheet Pile Wall</b>			
1. Steel Sheeting		<b>A</b> No deterioration of the steel sheeting due to corrosion, fatigue cracking or impact/overload damage is visible, interlocks intact.	
		<b>M</b> Minor deviation of the sheeting from its original location and/or corrosion has occurred and is visible through thinning, rusting, pitting, or perforating of the steel surface but does not affect the structural stability of the sheet pile wall. Interlocks show some separation.	
		<b>U</b> Major misalignment and/or corrosion has occurred, there is visible cracking of the metal, or significant deformation is visible through bulging, necking, or buckling of the sheets. Interlocks have separated causing gaps between adjoining sheets.	
2. Anchorage Connections		<b>A</b> No defects of the anchorage connections at the face of the sheeting are present.	
		<b>M</b> Minor misalignment and/or corrosion or rust is visible at the anchorage connections at the face of the sheeting, but the structural integrity of the soil anchor is not affected.	
		<b>U</b> Anchorage connections show significant misalignment and/or corrosion or other deteriorated conditions.	
3. Revetment of sheet pile toe		<b>A</b> Existing toe protection is properly maintained and no evidence of loss of ground through settlement or scour is visible.	
		<b>M</b> No or minimal toe protection displacement or scouring activity that could compromise the structural integrity of the sheet pile wall.	
		<b>U</b> Loss of ground at toe of sheet pile wall through foundation settlement or bottom scour has occurred endangering the integrity of the retaining wall and levee.	

Key: A = Acceptable. M = Minimally Acceptable;  
Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
<b>Encroachments Within the Levee Prism</b>			
Culverts/Pipes (This item includes both the roof drains along the west side of the hotels and the pipe within the levee on the east side of the strium parallel to the parking garage.)		<b>A</b> There are no breaks, holes, cracks in the pipes/ culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Metal pipes, are in good condition with 100% of the original coating still in place (either asphalt or galvanizing) or have been relined with appropriate material, which is still in good condition. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		<b>M</b> There are a small number of corrosion pinholes or cracks that could leak water and need to be repaired, but the entire length of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal. A limited number of joints may have opened and soil loss may be beginning. Any open joints should be repaired prior to the next inspection. Metal pipes, may be showing corrosion and pinholes but there are no areas with total section loss. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		<b>U</b> Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or as already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert. HOWEVER: Even if pipes appear to be in good condition, as judged by an external visual inspection, an Unacceptable Rating will be assigned if the condition of pipes has not been verified using television camera video taping or visual inspection methods within the past five years, and reports for all pipes are not available for review by the inspector.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable.

Rated Item	Rating	Evaluation	Locations/Notes/ Recommendations
Electrical/Water/Sewer Utilities (This item includes both the utilities crossing the levee for the river boat and electrical conduits for the parking garage.)		<b>A</b> There is no evidence of breaks, holes, cracks in the pipes/conduits that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. There is no indication of settlement of the soils above the utilities. Seepage was not observed at the location where the utility crossing penetrates the protected side of the levee system. Nothing is observed which would indicate that the utility crossing will prevent the levee system from function properly during the next flood.	
		<b>M</b> Corrosion pinholes or cracks are present and need to be repaired, but the entire length of pipe/conduit is still structurally sound and is not in danger of collapsing. Pipes have been damaged and are no longer essentially circular. A limited number of joints may have been damaged and leaking of fluid and/or soil loss is occurring.	
		<b>U</b> Sewer or Water pipes has deterioration and/or has significant leakage. Electrical conduits are in danger of collapsing or have already begun to collapse. During the last flood event seepage or settlement was observed at the location where the utility penetrated the protected side of the levee.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable.

***River Geomorphology Observations (to be performed by a trained Professional)***

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***Performance and Condition of Riprap Stabilization Measures (to be performed by a trained Professional):***

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***Additional Issues Noted During the Inspection:***

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# INDUSTRIAL PARK LEVEE

## RELIEF WELL PUMP TEST REPORT

Location (Sta):		Well #		Date:	
Time Started:		Time Completed:			
Time	Elapsed Time (Min)	Depth to Water (ft.)	Drawdown (ft.)	Flow in (GPM)	

SAND INFILTRATION TEST #1			
Time Started:		Time Completed:	
Flowmeter reading at Start (GPM)		Flowmeter reading at Stop (GPM)	
Pumping Rate (GPM)		Length of test (min)	
Outlet Valve Flow (GPM)		Rossum Reading (ml)	
Sanding Rate ml/min			

SAND INFILTRATION TEST #2			
Time Started:		Time Completed:	
Flowmeter reading at Start (GPM)		Flowmeter reading at Stop (GPM)	
Pumping Rate (GPM)		Length of test (min)	
Outlet Valve Flow (GPM)		Rossum Reading (ml)	
Sanding Rate ml/min			

## INDUSTRIAL PARK LEVEE

# RELIEF WELL PUMP TEST REPORT LOG

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## INDUSTRIAL PARK LEVEE

# RELIEF WELL PUMP TEST REPORT LOG

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## **APPENDIX E – ADDITIONAL FLOOD FIGHT AVAILABLE RESOURCES**

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Locally available equipment, labor, and material:

The City of Council Bluffs maintenance department resources and materials can be utilized in the event of an emergency. Items are located at the maintenance shop and include:

City Equipment:

Item	Quantity
Rubber Tire Roller	3
Tractor	4
Vac Truck/Flush Truck	4
Sweeper	1
Trailer	6
Pumps	7
Generators	6
Air Compressor	3
Gate Opener	1
Small power tools (saws, drills, etc.)	Varies
Portable Lights	2 Banks
Miscellaneous Equipment	5
Operators	5

City Material:

Item	Quantity
Sand Bags	1500
Sand & Gravel	5 Truck Loads
Lumber (posts, boards of various sizes)	Varies

See the following for other local resources available.

Other locally available resources include:

<b>Heavy Equipment/Construction Services:</b>	<b>Sand and Gravel Supply:</b>	<b>Sandbags:</b>
<u>R.D. Blue Construction</u> 20474 Monument Rd. Crescent, IA 712.328.0068 (See attached List)	Lyman Ritchie 1220 S. 8 <sup>th</sup> St. Council Bluffs, IA Sand and Gravel – as required	Frontier Bags 2420 Grant St. Omaha, NE 68111 402-342-8992 – as needed
<u>Rain for Rent</u> 221 McDonald Ave. Joliet, IL 815.744.3947 Emergency Dewatering Pumps – various Personnel – as required (engineering included)		
<u>USACE</u> Pumps (2)		
<u>L.G. Roloff Construction Inc.</u> 10204 S. 152 <sup>nd</sup> St. Omaha, NE		
<u>MFT Construction</u> 1426 9 <sup>th</sup> Ave. Council Bluffs, IA 712.323.7926		
<u>Carley Construction</u>		

\*City is to maintain a list of up-to-date contact information.

Locally Available Heavy Equipment/Construction Services

**R&D Blue Construction:**

<b>Items</b>	<b>Quantity</b>
Tractor & Trailer	2
Dump Truck	3
Backhoe	6
Rollers	2
Dozer	1
Tractor Backhoe	2
Bobcat	1
Loaders	3
Air Compressor	3
Compaction Attachment for Backhoe	3
Misc. Equipment (chainsaw, cutoff saws, tamper)	4
Operators	6

Items	Quantity
Laborers	17

**L.G. Roloff Construction Inc.:**

Type	Quantity
Excavator	6
Loader	17
Tractor	14
Rollers	7
Dozer/Grader	2
Sweeper	3
Generator	3
Pumps	6
Compressor	2
Pick-Up Trucks/Straight Truck	20
Light Tower	4
Trailers	4
Tractor Trailer	9
Chop Saw	2

**MFT Construction:**

Type	Quantity
Spant Work Bridge	2
Forklift	1
Grader	1
Dump Truck	4
Rubber Tire Backhoe	4
Trackhoe	6
Rollers	2
Dozer	2
Tractor Backhoe	2
Bobcat	4
Loaders	5
Loader Attachments	2
Pumps	2
Air Compressor	3
Pick-up Truck/Straight Truck	3
Light Tower	3
Trailer	4
Trator Trailer	3

Type	Quantity
Operators	2
Laborers	10

**Carley Construction:**

Type	Quantity
Grader	1
Dump Truck	1
Backhoe	1
Rollers	3
Dozer	1
Excavator	2
Skidloader	2
Scraper	1
Pumps	1
Welder	1
Pick-up Truck/Straight Truck	6
Light Tower	3
Trailer	3
Tractor Trailer	1
Chop Saw	4

\*City is to maintain up-to-date available resources information.